Appendix O

Comment Letters

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FA01

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

DEC 15 2014

Mr. Brad Hubbard
Bureau of Reclamation
2800 Cottage Way
Sacramento, California 95825

Subject: Draft Environmental Impact Statement for the Long Term Water Transfers Project, Various Counties, California (CEQ# 20140290)

Dear Mr. Hubbard:

The Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (DEIS) for the above referenced document. Our review is pursuant to the National Environmental Policy Act, Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

The Long Term Water Transfers Project would implement a 10-year water transfer program to move water from willing sellers upstream of the Sacramento/San Joaquin Delta to willing buyers south of the Delta. Long-term water transfers have the potential to provide improved flexibility in the allocation, management, and use of water resources. When implemented in conjunction with a water management system that includes efficiency improvements, conservation, and environmental protection, they can be an important tool for ensuring that California's scarce water supplies are put to their highest priority use. 1

While EPA supports the goal of improving water management flexibility, we also recognize that the Delta faces interrelated problems of inadequate water supplies, instream flow deficits, water quality impairments, and degraded aquatic habitats. Many of the groundwater aquifers that previously supported ecosystem processes across the estuary and provided water consumers with a hedge against drought have been overdrawn and depleted to historic levels. The extreme drought of the past 3 years has produced precipitous declines in groundwater elevations statewide, including level decreases of more than 10 feet for some monitored wells in the project area. Land subsidence associated with groundwater overdraft not only impacts infrastructure, water quality, and ecosystems, but also permanently reduces the State's capacity to store water underground. Water transfers would affect each of these conditions; therefore, they must be carefully designed and implemented, based upon the best available data, to ensure that adverse impacts are minimized and the interests of all affected parties and the environment are appropriately considered.

In the DEIS, BOR concludes that, after mitigation, the proposed project would result in less than significant or beneficial environmental impacts for all resources. Based on our review, EPA finds that the DEIS does not contain sufficient information to support this conclusion for many resource areas, particularly groundwater, air quality, fisheries, and wildlife. 2

The DEIS identifies potentially significant impacts to groundwater levels and land subsidence associated with groundwater substitution water transfers. It states that proposed mitigation would reduce these impacts to less than significant for all groundwater basins in the seller's service area. However, the 3
proposed mitigation is vague and defers the responsibility for developing detailed mitigation plans to the water transfer applicants. This precludes meaningful evaluation of the viability and effectiveness of BOR's proposed approach to mitigation. Furthermore, the modeling performed to assess groundwater-related impacts depends upon a data set spanning 1970 to 2003. The use of this truncated data set means that recent trends and current existing conditions are not appropriately taken into account in the impact 4
analysis. Absent sufficient information regarding both mitigation and existing conditions, the DEIS does not demonstrate that the proposed project would not adversely affect groundwater levels.

Similarly, while the DEIS concludes that mitigation measures would render potential impacts to air quality to less than significant levels, the two mitigation measures proposed for air impacts essentially amount to a guarantee from BOR that emissions will not be allowed to exceed applicable thresholds. 5
Without information on how these measures would be implemented and enforced on a transfer by transfer basis, it is not clear that the mitigation would successfully prevent exceedence of de minimis values under EPA's General Conformity rule or local air quality thresholds.

Finally, the DEIS analysis with regard to fisheries and terrestrial wildlife understates a number of potentially significant adverse impacts upon these resources, thereby rendering unsupportable the conclusion that these impacts will be less than significant. For both fisheries and wildlife impacts, 6
significance thresholds identified in the DEIS are focused around special status species, with insufficient regard for other native communities. It is not clear why the DEIS concludes that most potential impacts to non-special-status species are inherently less than significant. Even where special status species are concerned, the impact analysis frequently depends upon conjecture, without sufficient justification or citation for significance thresholds established and impact assessments made. For example, potential impacts to migratory bird species receive only a summary consideration. Wintering waterfowl in the Sacramento Valley gather as much as 50 percent of their nourishment from rice farms, yet the DEIS 7
concludes that the 16% reduction in flooded rice fields in some regions along the Sacramento River (11% when averaged across the entire sellers' service area) would be a less than significant project effect. The DEIS states that migrating species will simply choose appropriate habitat upon arrival. Neither this assumption, nor the conclusion that follows from it are well founded.

Similar data gaps and unsupported conclusions are common throughout the DEIS and warrant substantial revision prior to the publication of the Final EIS. The level of detail missing from the DEIS, particularly with regard to the specific provisions of likely transfer actions and the expected 8
requirements of future mitigation, results in an EIS document more appropriate to a programmatic analysis. Without further details regarding these aspects of the proposed project, EPA believes that the FEIS will not be sufficient to support project-level decision-making.

Based on EPA's review of the Draft EIS, we have rated the Proposed Action as Environmental Concerns - Insufficient Information (EC-2). This rating reflects the potentially significant adverse environmental impacts that the project, as proposed, may have upon the terrestrial and aquatic environments of the Delta and Sacramento Valley, the lack of consideration of appropriate mitigation for some project 9
impacts, and the need for improved disclosure related to air quality, water quality, groundwater, fisheries, vegetation/wildlife, economics, project alternatives, and mitigation. Please see the enclosed Summary of EPA Rating Definitions for a description of the rating system. Further discussion of our concerns is provided in the enclosed Detailed Comments.

EPA appreciates the opportunity to provide comments for this project. When the Final EIS is released for public review, please send one hard copy and one CD to the address above (Mail Code: ENF 4-2). If you have any questions, please contact me at (415) 972-3873 or contact Carter Jessop, the lead reviewer for this project. Carter can be reached at (415) 972-3815 or jessop.carter@epa.gov. 9

Sincerely,

Lisa B. Hanf for

Kathleen Martyn Goforth, Manager
Environmental Review Section

Enclosures:
Summary of EPA Rating Definitions
Detailed Comments

cc:
Ren Lohoefener, Pacific Southwest Region, U.S. Fish and Wildlife Service
Maria Rea, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
Helen Birss, California Department of Fish and Wildlife
Diane Riddle, California State Water Resources Control Board
Karen Huss, Sacramento Metropolitan Air Quality Management District
Frances Mizuno, San Luis & Delta-Mendota Water Authority

SUMMARY OF EPA RATING DEFINITIONS*

This rating system was developed as a means to summarize the U.S. Environmental Protection Agency's (EPA) level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the Environmental Impact Statement (EIS).

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

ADEQUACY OF THE IMPACT STATEMENT

"Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, Policy and Procedures for the Review of Federal Actions Impacting the Environment.

EPA Detailed Comments for the Long Term Water Transfers Draft EIS, Various Counties, California, December 15, 2014

Air Quality

The proposed project spans five air basins, including numerous attainment, nonattainment, and
maintenance areas for a number of National Ambient Air Quality criteria pollutants. Groundwater
substitution water transfers would necessitate the use of diesel, natural gas, or electrically powered
pumps. According to the DEIS (p. 3.5-38), and as referenced in Appendix F (page F-1), the emissions
from these pumps, in particular those powered by diesel fuel, have the potential to exceed the applicable
de minimis value for nitrogen oxides (NOx) established under EPA's General Conformity Rule for the
Sacramento Metro non-attainment area. Table F-1 indicates that unmitigated emissions would exceed
the de minimis threshold nearly fourfold. In addition, groundwater substitution pumping has the 10
potential to emit criteria pollutants at levels that exceed local air district significance thresholds for
volatile organic compounds (VOCs) and NOx in the Feather River Air Quality Management District and
for NOx for the Sacramento Metropolitan AQMD.

In order to address these potential impacts, the DEIS includes mitigation measure AQ-1: "Reduce
pumping at diesel or natural gas wells to reduce pumping below significance levels." (p. 3.5-43) It
indicates that, following application of this measure, all project emissions are modeled to fall below
applicable thresholds. EPA is concerned that measure AQ-1 is very vague. The single paragraph
description provided is insufficient to determine whether this measure is capable of achieving the
described emissions reductions. It is unclear how BOR would limit diesel or natural gas well pumping
and manage individual transfer permits to ensure cumulative compliance. The mechanisms for both
emissions accounting and enforcement are similarly unclear. Measure AQ-1 also stipulates that "if an
agency is transferring water through cropland idling and groundwater substitution, the reduction in
vehicle emissions can partially offset groundwater substitution pumping at a rate of 4.25 acre-feet for
water produced by idling to one acre-foot of groundwater pumped." The DEIS provides no citation or 11
explanation for how the 4.25 AF/1 AF ratio was determined. Given the range of potential emissions
rates associated with pumps of various ages/tiers and fuel types, plus the differing water needs of
various crops, it is unclear how a single ratio of groundwater pumping to cropland idling was derived
and deemed universally applicable.

EPA's guidance on the General Conformity applicability analysis states, "the Federal agency can take
measures to reduce its emissions from the proposed action to in fact below de minimis levels and, thus,
the rule would not apply. The changes must be State or Federally enforceable to guarantee that
emissions would be below de minimis in the future."[1] While California Environmental Quality Act
mitigation measures may be enforceable under state law, the vague language of AQ-1 falls short of 12
guaranteeing the de minimis thresholds will not be exceeded. Without additional information regarding
the mechanism and enforcement for mitigation measure AQ-1, the DEIS does not demonstrate that
emissions of NOx in the Sacramento Metro non-attainment area would be limited to below the de
minimus threshold.

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[1] General Conformity Guidance: Questions and Answers (Response to Question 29), July 13, 1994 <http://www.epa.gov/air/genconform/documents/gcgqa_940713.pdf>

Recommendation: Include in the FEIS a detailed description of the processes by which BOR would approve, disapprove or approve with conditions those transfer applications within the Sacramento Metro AQMD such that emissions are maintained below the applicable de minimis and local significance thresholds; similarly for the Feather River AQMD. In order to demonstrate compliance with the General Conformity Rule, the FEIS should clearly show how the proposed mitigation measure would be implemented and enforced. Describe the mechanism for compliance assurance and enforcement, and clearly demonstrate the calculation leading to the 4.25 AF of water produced by idling to one AF of groundwater pumped ratio. Explain why this value is appropriate for all pumping/idling scenarios. 13

The Department of Agriculture's Natural Resource Conservation Service has a program to promote agricultural production and environmental quality as compatible goals, optimize environmental benefits and help farmers and ranchers meet Federal, State, Tribal, and local environmental regulations. Through the Environmental Quality Improvement Program (EQIP), NRCS provides incentive funding to agricultural producers specifically to reduce NOx, VOCs, PM10 and PM2.5. Currently, incentive funds are available throughout California. The funded conservation practices include the replacement of internal combustion engines in irrigation pumps. For more information, go to http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/programs/financial/eqip/?cid=stelprdb1247003. As the DEIS notes, a California Air Resources Board airborne toxic control measure contains a schedule for the replacement of older and dirtier diesel agricultural engines. 14

***Recommendation*:** Work with irrigation districts to ensure that individual growers participating in the project are aware of NRCS incentive funding to reduce project related air quality impacts. The FEIS should describe this program and the benefits it might offer for reducing potentially significant air quality impacts with regard to General Conformity.

Groundwater Resources

The proposed project has the potential to cause or exacerbate overdraft of groundwater in the sellers' service area if groundwater substitution transfers are not carefully managed, and if mitigation is not aggressively enforced. One of the primary mechanisms whereby water transfers would be made possible under the proposed action is by groundwater substitution. A seller would pump groundwater in lieu of drawing that same volume of surface water from canal or stream flow. That surface water allocation (less carriage water) would then be sold downstream to a willing buyer in the buyer service area. California's limited regulation of groundwater resources has allowed overdraft of groundwater in parts of the State. When groundwater elevations fall below historic lows, aquifers of certain geologies are subject to collapse, resulting in land subsidence. Areas subject to land subsidence have experienced particularly severe financial and ecological repercussions from groundwater overdraft. These impacts stretch far beyond the individuals pumping the groundwater, impacting entire communities and ecosystems. Furthermore, in dry and critical years, a lack of available water leads a greater proportion of water users to pump groundwater to supplement diminished surface water supplies. These circumstances are likely to co-occur with periods of the greatest number of groundwater substitution transfers. 15

The analysis of groundwater impacts assumes that transfers would occur at a rate of 12 out of 33 years, or 36% of the time (p. 2-13), based upon the period of record from 1970 to 2003. This data set is truncated to this period due to the limitations of the CalSim II model used, not because this period was deemed to be the most appropriate to represent future conditions. In fact, according to the DEIS (p. 1- 16

17), north-of-delta to south-of-delta water transfers have taken place in 9 of the past 15 water years -- a rate of 60%. This is nearly double the transfer frequency assumed by the modeling performed.

The proposed project would likely ease and expedite the water transfer process during its 10-year term
by removing the need for independent environmental review for transfer approval. The available data
suggest that drought frequency will increase and water supply reliability decrease in coming decades as 16
the effects of global climate change take hold of the State (p. 3.6-12). For this reason, it seems
reasonable to assume that the frequency of water transfers during the 10-year project term would be at
least equivalent to the past 15 years, if not more frequent. This discrepancy could potentially have very
substantial influence on the predicted environmental impacts of the project. The conclusions reached in
the DEIS regarding impacts upon groundwater elevations, land subsidence, streamflow, water quality,
fisheries, wildlife, and economics are predicated on the assumption that natural recharge in non-transfer
years will replenish groundwater aquifers. If the modeling performed were based upon the past 15 years
of record, the environmental outcomes predicted for each of these resource areas would likely differ
from those described in the DEIS.

> ***Recommendations:*** Complete additional modeling that is more representative of current and
> future reasonably foreseeable conditions with regard to transfer frequency. These results should 17
> be incorporated into each major resource area so potential adverse effects can be properly
> characterized. If the framework of CalSim II does not accommodate such modeling, we
> recommend that BOR perform a sensitivity analysis to determine the effect of this discrepancy
> upon overall conclusions regarding project impacts. In addition, BOR should consider what
> additional tools might be available for more accurately predicting likely project impacts in the
> event that transfer frequency occurs closer to the rate observed in the past 15 years.

The DEIS is internally inconsistent in defining and treating baseline/existing groundwater elevations.
The characterization of existing groundwater conditions uses data sets that conclude at dates ranging
from 1995 to 2013, and none include data from the 2013-2014 critical drought year. Where older,
outdated data are used, it is possible that recent trends in groundwater elevations or land subsidence are
not represented in the analysis. The current drought is perhaps the most severe the state has ever
experienced and would be the relevant baseline for additional impacts from the proposed action, slated
to commence in 2015. According to the California Department of Water Resources' November 2014
Drought Update[2], over 50 percent of monitored wells in the Central and Sacramento Valleys have 18
experienced groundwater level decreases of 2.5 feet or more from spring of 2013 to spring of 2014, with
over 20% experiencing decreases of more than 10 feet. For the period from spring 2010 to spring 2014,
nearly 30% of monitored wells have experienced declines in excess of 10 feet. While the most severe
declines occur in the San Joaquin basin, precipitous declines are none-the-less prevalent across a
majority of the sellers' service area. Due to these recent declines, some of the monitored wells in the
sellers' service area may have reached historic low levels. Consequently, we are concerned that the
extent of, or potential for, land subsidence may be greater than is reflected in the DEIS.

According to the DEIS, five of eleven extensometers placed in the Sacramento Valley Groundwater
Basin to monitor land subsidence are showing some amount of subsidence on an annual basis. This 19
suggests that groundwater elevations are likely falling below historic lows in some portions of the
Sacramento Basin. Analysis of data from the National Aeronautics and Space Administration (NASA)

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[2] "Public Update for Drought Response: Groundwater Basins with Potential Water Shortages, Gaps in Groundwater Monitoring, Monitoring of Land Subsidence, and Agricultural Land Fallowing," Department of Water Resources, November 2014, http://www.water.ca.gov/waterconditions/docs/DWR_PublicUpdateforDroughtResponse_GroundwaterBasins.pdf

Gravity Recovery and Climate Experiment (GRACE) satellite mission suggests that, in the Central 19 Valley, including the Sacramento basin, substantial loss of groundwater storage has occurred across the period of 2003 to 2010.[3]

> ***Recommendation*:** Ensure that the most current groundwater elevation and land subsidence data available are used in the characterization of existing conditions and the determination of likely project effects in the FEIS. The FEIS should examine all available data sources regarding 20 groundwater elevations in the seller's service area and include a more thorough consideration of alternate data sources, given data limitations at some monitoring points. We recommend that the FEIS include specific requirements that prohibit the pumping of groundwater below historic lows where the risk of subsidence is present.

The DEIS outlines a monitoring and mitigation measure for ensuring that potentially significant impacts to groundwater are offset; however, this measure (GW-1, p. 3.3-88) largely defers the specifics to a required monitoring and mitigation plan to be developed by the water seller for approval by DWR and BOR in an independent post-NEPA permitting process. While a general framework is offered in the DEIS for how mitigation would be constructed, greater detail is needed to sufficiently demonstrate that environmental harm would be offset. The DEIS states that measure GW-1 will mitigate all impacts from groundwater pumping, placing responsibility for mitigating any "significant adverse impacts" of 21 groundwater pumping on the water seller. Beyond the statement that mitigation "could include… curtailment of pumping until water levels raise above historic lows if non-reversible subsidence is detected," no more specific mitigation thresholds or triggers are provided. Inelastic subsidence is a permanent impact. Implementation of mitigation after it has been monitored to occur means that an irreversible and irretrievable commitment of resources will have occurred. The measure also does not include monitoring or mitigation specifically related to minimizing harm to the aquatic environment. It is not clear what actions could or would be taken if groundwater substitution pumping were found to be dewatering a stream or water body (see comments on stream flow and fisheries impacts).

Measure GW-1 includes language placing financial responsibility on the transferring party for any repercussions of their pumping on others, including the cost to neighbors if the neighbors' pumping expenses increase, and the costs of infrastructure repair or improvements that may be required due to lower groundwater elevations or non-reversible land subsidence. However, as presented in the DEIS, 22 these provisions are unlikely to be enforceable. The DEIS does not include metrics by which claims would be judged and processed, and responsibility apportioned, nor timeframes in which decisions would be made. Also, the DEIS does not define how "assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs" would be made. Where offsetting a neighbor's pumping expenses or replacing public infrastructure is concerned, the expense to the transferring party could easily exceed the financial benefit of the water transfer by many times over.

> ***Recommendation*:** Provide greater detail about monitoring and mitigation measure GW-1 in the FEIS. The FEIS should include clearly defined mitigation triggers for the foreseeable range of 23 potential environmental impacts associated with groundwater substitution transfers, including potential impacts to groundwater elevations, land subsidence, streamflow, fisheries, vegetation, and wildlife. We recommend that Measure GW-1 be revised to improve its enforceability, including providing metrics by which claims would be judged and responsibility would be apportioned, and timeframes in which decisions and distribution of reimbursements would be

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[3] Famiglietti, J. S., Lo, M., Ho, S. L., et al. "Satellites measure recent rates of groundwater depletion in California's Central Valley," Geophysical Research Letters, 5 Feb, 2011.

made. The FEIS should also define what constitutes "adequate financial resources to cover reasonably anticipated mitigation needs" and how their availability would be ensured. 23

Page 3.7-26 of the DEIS states that stream flow reductions as the result of groundwater declines would have a less than significant impact upon fisheries and riparian resources because they "would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1." The principle mitigation for this impact is the curtailment of pumping until natural recharge corrects the environmental impact. The DEIS 24 overestimates the effectiveness of this measure in avoiding harm to fisheries and riparian resources. Following the curtailment of pumping, a lag time would exist between when the effects of groundwater on streamflows are detected and when the curtailment of pumping would result in the augmentation of stream flows. This lag time could be months to years depending on specific ground and surface water conditions. During this lag time, significant adverse impacts to fisheries could occur.

Recommendation: Define, in the FEIS, triggers that would be used to make the decision to continue pumping or to cease pumping. For example, define at what depth below historic lows 25 groundwater pumping would be curtailed, and at what point land subsidence measures are considered to be too great to be elastic and pumping would cease. The FEIS should more accurately characterize the potential for harm to fisheries resources during the lag time between impact observation and mitigation benefit.

In September of this year, Governor Jerry Brown signed a suite of three bills -- AB 1739, SB 1168, and SB 1319 -- collectively called the Sustainable Groundwater Management Act, with the intended goal of moving toward the sustainable management of unadjudicated groundwater basins throughout the state. This legislation will be enacted across the term of the Long Term Water Transfers project and has the 26 potential to affect the proposed project.

Recommendation: Discuss the Sustainable Groundwater Management Act in the FEIS. The stipulations of this legislation should be identified in the "Regulatory Framework" portion of section 3.3. The FEIS should also discuss the potential effects of this legislation on the actions proposed for this project.

<u>Streamflow Impacts and Water Quality</u>

The proposed project would affect the quantity and timing of streamflows throughout the sellers' service area and downstream into the Sacramento/San Joaquin Delta. In an aquatic ecosystem that has already 27 been severely degraded by reduced instream flows related to freshwater diversion and groundwater overdraft, any action with the potential to further reduce flows has the potential to significantly impair water quality. The DEIS states that, due to the timing and magnitude of potential impacts to streamflow, the project will not cause violation of any Delta water quality standards (p. 3.2-40).

The release of transfer carriage water, defined as the "portion of the transfer that is not diverted in the Delta and becomes Delta outflow" (p. 2-29), has the potential to increase outflows by an average of 1.8% (p. 3.2-47) between October and June. The DEIS states that streamflow losses associated with reservoir refilling, groundwater recharge, and loss of irrigation return water are modeled to reduce Delta outflows by up to 0.3 percent during the spring and winter months (3.2-47). However, as discussed in 28 our comments on groundwater resources, the DEIS analysis assumes that water transfers will take place in approximately 35% of water years, while in the past 15 years, transfers have occurred at almost double this frequency. In the event that transfers occur as often as, or perhaps more often than, observed in recent history, groundwater aquifers may not fully recharge between transfers, resulting in greater impacts to streamflows. Furthermore, it is unclear how the increase in Delta outflow was calculated given that the percent of a given water transfer that will be required for carriage is variable -- assumed for some transfers to be as much as 20% (Sacramento River) and for others to not apply at all (EBMUD diversions) (p. B-18). If the data presented in the DEIS are average values, it is necessary to understand the maximum possible streamflow loses in order to determine the range of possible project impacts. 28

> ***Recommendations:*** Describe in the FEIS how an increase in transfer frequency might affect expected streamflow and water quality impacts. Clarify how the proportion of a transfer deemed "carriage water" is determined and how these values were used to calculate expected changes in streamflow resulting from project actions. 29

The California State Water Resources Control Board (State Board) has proposed flow criteria for the lower San Joaquin River Basin[4] and is in the process of preparing a comprehensive update of the Bay Delta Water Quality Control Plan (Bay Delta WQCP) that will include flow criteria for the Delta as a whole.[5] The State Board's 2010 Flows Report[6] underscores the need to increase flows to and through the estuary to support ecosystem processes, safeguard aquatic life, and protect imperiled species. It is not clear whether or how the proposed project would comply with these new requirements at all times. 30

Any water transfer program will have to be designed for operational flexibility so it can comply with existing water quality standards (such as the X2 salinity standard within D-1641[7]), and potentially more stringent standards once the comprehensive Bay Delta WQCP is completed. On the whole, these new requirements are anticipated to necessitate that less water be diverted for human consumption and more be left in the river for aquatic life. While Appendix B provides detailed analysis of the project's potential effects on the X2 salinity standard, the current text of the DEIS constitutes an insufficient summary of these data (p. 3.2-40). In addition, the modeling performed for assessing impacts to the position of X2 relies upon monthly averages of that position. Monthly averages are not the appropriate "time step" as they can mask violations and standards. Impacts to the position of X2 must be analyzed and evaluated in the units in which the standard is written in order to demonstrate compliance. 31

> ***Recommendations***: Recent proposals by the State Board to include specific flow requirements in future Water Quality Control Plans for the Sacramento/San Joaquin River Delta should be discussed in the FEIS. Explain how the proposed project would be designed and operated with the flexibility needed to achieve compliance with current water quality standards and future standards that might be significantly more stringent. 32

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[4] State Water Resources Control Board. December 2012. Public Draft Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality.
http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2012_sed/

[5] http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/

[6] http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf

[7] http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/decision_1641/index.shtml. X2 refers to the distance from the Golden Gate up the axis of the estuary to the point where daily average salinity is 2 parts per thousand at 1 meter off the bottom. X2 provides a surrogate measure for the low salinity zone favored by an assemblage of native fish where abundance and survival is statistically greater than in other parts of the estuary. http://online.sfsu.edu/modelds/Files/References/JassbyEtAl1995EcoApps.pdf

Streamflow modeling data should be analyzed to determine any change in the position of X2 on a daily basis through time in order to demonstrate that water transfers would not cause the X2 standard to be violated. Include in the FEIS a fuller summary of the data contained in Appendix B to properly support the assertion that the proposed project would not violate the existing X2 standard. If any violations of the X2 standard are found in the modeling to occur on a daily basis, the FEIS should identify this significant impact, indicate the frequency of modeled exceedance, and discuss mitigation that would prevent this impact. 33

The DEIS states that changes in streamflow of less than ten cubic feet per second (cfs) are assumed to have no impact upon water quality (p. 3.2-27). This assumption is not supported with appropriate citation or data. The explanation that changes of less than 10 cfs are outside the accuracy of the model employed is insufficient to demonstrate that this threshold is physically or chemically appropriate. Depending on water levels and flow conditions, a loss of 10 cfs could degrade water quality. 34

Recommendation: Explain, in the FEIS, the basis for the assumption that streamflow changes of less than 10 cfs would not affect water quality. If data supporting such an assumption are not available, we recommend that BOR reconsider its use of this assumption for its analysis. If a lower threshold for significance is deemed appropriate, but the available modeling tools lack the resolution to predict all impacts at this threshold, we recommend that the remaining uncertainty be clearly identified in the FEIS and a precautionary approach be taken with regard to permitting water transfer related actions. 35

The DEIS considers potential streamflow impacts to smaller tributaries in Section 3.7. It states that, for rivers and their major tributaries, groundwater and streamflow modeling was compared against historical flow data to assess impacts to surface water flows. For smaller streams and water bodies, where insufficient data were available to allow this approach, the analysis assumed that streamflow response was similar to that of larger adjacent modeled waterways. This approach is significantly flawed. Model resolution is not the appropriate basis for excluding smaller waterways from a more detailed examination. Smaller water bodies will respond differently to changes in groundwater contributions than will larger water bodies and are potentially much more sensitive to small changes in flow magnitude and frequency. Where a loss or reduction in groundwater contributions to a section of a large water way may result in a small reduction in flow, but no loss of ecological function, the same reduction in groundwater contributions to a smaller tributary stream could result in near or complete dewatering and a significant degradation of ecological function. 36

Recommendations: Additional site specific information, including streamflow data and the likely proportion of flow contributed by groundwater, is needed in order to determine the likely effect of groundwater substitution transfers on smaller streams and waterbodies in the sellers' service area. The FEIS should explicitly identify where uncertainty exists due to model limitations, and describe the range of potential impacts contained within that uncertainty. In the absence of the necessary site specific data for a more comprehensive analysis, we recommend that BOR consider taking a precautious approach to minimize potential ecological risk. 37

The DEIS states that changes in stream flows on the San Joaquin River and in the Sacramento/San Joaquin Delta will be less than significant because total reductions in flow will be only a fraction of a percent. A two percent reduction in flow is identified as the threshold for significance for this impact. A more refined analysis of impacts to species would have to be conducted to determine whether this 38

significance threshold is biologically appropriate. According to the State Board,[8] U.S. Fish and Wildlife
Service,[9] NMFS,[10] and the California Department of Fish and Wildlife,[11] existing conditions in the San
Joaquin River basin are not adequate to protect aquatic life. All three fisheries agencies identified 38
salmon and steelhead populations as declining under current flow conditions. The DEIS does not
provide sufficient support for the conclusion that this further reduction in flow would not adversely
affect these species or other native aquatic species.

The DEIS indicates that, under the proposed project, the many waterways in the project area are likely to
experience higher flows during some portions of the year but lower flows during wetter periods. There
are many benefits to maintaining flood flows in rivers in wet years as they inundate floodplains and
initiate ecosystem processes that support aquatic life. Juvenile salmon will rear on seasonally inundated 39
floodplains when available. This has been found to increase growth and survival in the Central Valley,
specifically in the Yolo Bypass and the Cosumnes River floodplain.[12, 13] These benefits to the ecosystem
would be lost if peak flows and flood pulses are suppressed, and contribute increased stress on fish
populations that are already adversely affected by flow diversions (e.g., loss of spawning gravels,
reduced foraging habitat, loss of cold water).

> ***Recommendation***: More thoroughly analyze the project's potential impacts on native
> ecosystems, including sensitive and endangered species, from changes in streamflow. Clearly 40
> define, in the FEIS, the criteria used for defining harm to species. Where significant impacts are
> found to occur, the FEIS should discuss potential mitigation measures.

The idling of cropland has the potential to result in increased sediment runoff to local waterbodies. The
document contends that this impact is expected to be less than significant due to the crust-like surface
formed on rice fields after they are drained and the assumption that farmers idling upland crops will 41
employ soil retention measures (p. 3.2-29). The DEIS does not discuss the possible benefits of planting
cover crops toward preventing sediment runoff, especially where landowners choose not to employ other
erosion control techniques.

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[8] State Water Resources Control Board, 3 Aug. 2010, Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem Prepared Pursuant to the Sacramento-San Joaquin Delta Reform Act of 2009, (2010 Flows Report), available at http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf

[9] "Interior remains concerned that the San Joaquin Basin salmonid populations continue to decline and believes that flow increases are needed to improve salmonid survival and habitat." USFWS May 23, 2011 Phase I Scoping Comments:http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/cmmnts052311/amy_aufdemberge.pdf

[10] "Inadequate flow to support fish and their habitats is directly and indirectly linked to many stressors in the San Joaquin river basin and is a primary threat to steelhead and salmon." NMFS Feb. 4, 2011 Phase I Scoping Comments: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/cmmnts020811/010411dpowell.pdf

[11] "…current Delta water flows for environmental resources are not adequate to maintain, recover, or restore the functions and processes that support native Delta fish." Executive Summary of California Department of Fish and Game, November 23, 2010, Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta.

[12] T. R. Sommer, M.L Nobriga, W.C. Harrell, W. Batham, and W.J. Kimmerer. 2001. Floodplain rearing of juvenile Chinook salmon: evidence of enhanced growth and survival. Can. J. Fish. Aquat. Sci. 58: 325-333.

[13] C. A. Jeffres, J. J. Opperman, and P. Moyle. 2008. Ephemeral floodplain habitats provide best growth conditions for juvenile Chinook salmon in California river. Environmental Biology of Fishes. Published online June 6, 2008: www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/usdoi/spprt_docs/doi_jeffres_2008.pdf

Recommendations: Discuss, in the FEIS, the feasibility and benefit of planting or encouraging 42
the growth of cover vegetation for reducing soil erosion and sediment runoff into waterways.

Fisheries

Chapter 3.7 of the DEIS assesses the project's potential impacts upon fisheries. EPA finds that the analysis performed lacks the resolution necessary to identify the full range of potentially significant adverse impacts the project may have upon fisheries, including potential impacts on special status species. The modeling performed for this analysis relied upon the flawed assumptions that a transfer 43
action would have no adverse impact upon fisheries if modeled flow reduction were of less than one cubic foot per second (cfs) or less than a ten percent change in mean flow by water year type (p. 3-7-20). These assumptions inappropriately limit the scope of the impact analysis and undermine the accuracy of the conclusions reached.

The DEIS contends that any change in flow of less than ten percent falls within the "noise of model outputs and beyond the ability to measure actual changes" (pg. 3-7-20). It is not logical nor acceptable for purposes of this analysis to conclude that biological impacts are limited to the range of flow changes capable of being represented by the model employed. Research has examined the effects of implementing freshwater flow prescriptions for rivers and estuaries that mimic the pattern of the natural hydrographs in order to protect aquatic species with life histories adapted to such flow patterns.[14] For example, work performed by Richter, et. al.[15] on riverine systems in Florida, Michigan, Maine, and the European Union found that the maximum cumulative depletion of flows allowable to ensure adequate 44
protection of aquatic species ranged from 6 - 20% year-round or in low-flow months and 20-35% in higher flow months. These scientists recommended the equivalent of no less than 90% of natural flow to achieve a high-level of ecological protection, and no less than 80% of natural flow to achieve a moderate level of ecological protection. Central Valley watersheds experience a much higher proportion of flow alteration than these scenarios. For example, during a median year in the San Joaquin River system, only 31% of the natural flow is allowed to remain in the river channel.[16] In a system that is so severely impacted with regard to streamflow, additional reductions in flow of less than ten percent have the potential to cause significant adverse impacts.

Similarly, because streams and stream flows vary greatly at the reach scale due to environmental heterogeneity, changes of less than 1 cfs can have significant adverse effects on fishes and amphibians, 45
depending on the specific reach affected and the conditions in that reach at the time of impact. Fishes, especially special status species, rely on high quality reaches as refugia for population persistence. Any degradation of reach quality has the potential to affect population vitality.

According to the DEIS, the Central Valley Project Improvement Act of 1992 requires that a transfer 46
"will not adversely affect water supplies for fish and wildlife purposes" (p. 1-11). Based upon the

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[14] "*Major researchers involved in developing ecologically protective flow prescriptions concur that mimicking the unimpaired hydrographic conditions of a river is essential to protecting populations of native aquatic species and promoting natural ecological functions*". (Sparks 1995; Walker et al. 1995; Richter et al. 1996; Poff et al. 1997; Tharme and King 1998; Bunn and Arthington 2002; Richter et al. 2003; Tharme 2003; Poff et al. 2006; Poff et al. 2007; Brown and Bauer 2009). SED. Appendix C, p. 116

[15] Richter, B. D., Davis, M., Apse, C., and Konrad, C. P. 2011. A presumptive standard for environmental flow protection. River Research and Applications. DOI: 10.1002/rra.1511. http://eflownet.org/downloads/documents/Richter&al2011.pdf

[16] EPA Comments on the Bay Delta Water Quality Control Plan, Phase I SED. March 28, 2013. Available at: http://www2.epa.gov/sites/production/files/documents/sfdelta-epa-comments-swrcb-wqcp-phase1-sed3-28-2013.pdf

information provided in the DEIS, it is not clear that this provision would be met if the "Full Range of Transfer Measures" project alternative (the preferred alternative) is implemented as currently described. 46

> ***Recommendations**:* Perform additional modeling and analysis to more accurately assess potential impacts of the project upon fisheries. We recommend discarding the flawed assumptions that underpin the analysis performed for the DEIS. The FEIS should disclose when model resolution is too coarse to capture flow changes with the potential to adversely impact 47
> fisheries, and identify measures that would avoid or mitigate adverse impacts to fisheries and the aquatic environment in connection with actions authorized by the proposed project. Explain how and when the need for implementation of such measures would be determined.

The bulk of the analysis presented in section 3.7 of the DEIS focuses primarily upon the proposed project's potential impacts upon a short list of "species of management concern". It is unclear why the numerous other native fishes potentially affected by the proposed project are not more thoroughly examined. For example, page 3.7-9 provides a list of waterways that do not contain special-status fish species, followed by the statement, "as a result, no further biological analysis was conducted in these waterways". It is not clear why the DEIS concludes that potential impacts to non-special-status species 48
are inherently less than significant. Numerous native species may inhabit these waterways and may be exposed to adverse conditions as a consequence of this project. Furthermore, the DEIS does not demonstrate that potential impacts to fish assemblages or communities were considered, only impacts upon individual species. While protection of individual special status species is important, the project's potential impacts upon fisheries at the ecosystem scale may be equally significant and worthy of consideration.

> ***Recommendations:*** Discuss, in the FEIS, the proposed project's potential impacts upon all native species, rather than focusing solely upon "species of management concern"; this should include analysis of potential impacts upon waterways previously eliminated from analysis for 49
> fisheries impacts. We recommend that the FEIS analyze potential impacts to multi-species communities, rather than focus solely on single-species impacts.

The DEIS explains that native fishes assemblages in the deep-bodied fishes zone have been replaced largely by non-native assemblages, citing "Moyle (2002)" (page 3.7-6). While this is generally true for the San Joaquin River, it is not an accurate characterization for the Sacramento River system. Many 50
more recent studies of fishes in the Sacramento River system have been produced since 2002 that more accurately characterize the current condition of fisheries in that system.

> ***Recommendations:*** A review of available scientific literature related to the fish assemblages of the Sacramento River should be conducted and the most current reliable data should be employed for defining existing conditions and determining potential project impacts. Based on 51
> this review, clarify the potential for the proposed project to adversely affect native fish assemblages in the deep-bodied fishes zone. EPA would be willing to assist BOR in acquiring the relevant literature, if needed.

The DEIS understates potentially significant impacts to anadromous fish species by focusing on peak habitation times and locations, without regard for the potentially substantial number of individuals who may occur in waterways outside of peak times. For instance, water transfers, which would occur from 52
July through September, would coincide with the spawning period of winter-run Chinook salmon. The DEIS states that "spawning occurs upstream of the areas potentially affected by the transfers. Due in

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part to elevated water temperatures in these downstream areas during this period, emigration would be complete before water transfers commence in July." (pg. 3.7-12) While most winter-run emigration is completed between Sept-June, not all emigration is complete by the end of June, and this is important for such a diminished species because every individual counts. Depending on the water year and river conditions, some fish continue to emigrate beyond June. Therefore, the conclusion that no potential effect to winter-run Chinook salmon emigration would occur is not supported. Similarly, the DEIS indicates that impacts to spring-run Chinook salmon would be less than significant because "the bulk of upstream migration (March-September, peaking May-June) and emigration (November-June) would be complete before water transfers commence in July" (pg. 3.7-13 to 14).

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While most migration may occur outside the proposed transfer period, the DEIS does not discuss in sufficient detail the potential adverse effects of the proposed project upon those migrating or emigrating fish that would be present in waterways affected by transfer actions. Furthermore, the DEIS contends that, while summer rearing of Central Valley steelhead would overlap with water transfers in the Seller Service Area, "the majority of rearing…would occur in the cooler sections of rivers and creeks above the influence for the water transfers." (page 3.7-15). This statement requires a citation if it is to serve as the basis for concluding that potential adverse effects on Central Valley steelhead summer rearing is unlikely to occur. Again, while most of the rearing may occur outside the area to be adversely affected by water transfers, the DEIS suggests that this is not the case for all rearing, and this potential adverse effect is not quantified or analyzed in sufficient detail.

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> ***Recommendation:*** The FEIS should accurately characterize the potential impact upon winter-run Chinook salmon and Central Valley steelhead. Where adverse impacts are likely to occur, potential mitigation measures should be proposed and analyzed.

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The discussion of potential impacts to steelhead and hardhead understates potential impacts and ignores the potential consequence for these populations where consecutive dry or critically-dry water years occur. The DEIS states that, although juvenile steelhead and hardhead could be present in some rivers affected by reductions in flows, those reductions occur "only one month and one water year type in one month," and therefore this impact is not expected to have a substantial effect on these species (page 3.7-28), but the potential adverse effects on these species during this one month period are not clearly characterized. If mortality is possible due to adverse stream conditions, then the brief duration of this impact does not necessary ensure minimal harm. Furthermore, if a dry or critically-dry year follows one of the same, the adverse effects during this one month period could be compounded.

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> ***Recommendations***: Clearly explain the criteria used to conclude that these potential effects on steelhead and hardhead would be less than significant. The cumulative effect analysis should encompass consecutive dry and critically-dry years.

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Migratory Birds

With the large-scale conversion of Central Valley riparian forests and wetlands to agriculture and suburban development, birds and other wildlife have become increasingly dependent on agricultural lands for food and cover. Ricelands serve as essential breeding and wintering habitat for nearly 187 species of birds, 27 species of mammals, and 15 species of reptiles (of which 30 are considered special-status species)[17]. The DEIS focuses almost exclusively on the proposed project's potential adverse

[17] *"Wildlife Known to Use California Ricelands,"* 2011. Prepared for California Rice Commission http://calrice.org/pdf/wildlife/Species-Report.pdf

effects upon special status species while potentially significant adverse effects upon migratory birds are either discounted or ignored altogether. Ricelands provide a high-value food source from the 75,000 tons 57
of grain estimated to remain on the ground each year due to harvesting inefficiencies. As a result, wintering waterfowl are estimated to gather more than 50% of their nourishment from ricelands.

The DEIS contends that a reduction in acres of flooded agricultural fields in the Delta resulting from the idling of cropland and the shifting of crops would not affect species migrating to the project area during spring because these species would simply select suitable habitat upon arrival (Section 3.8.2.4.1). But the proposed project could remove up to 51,473 acres (p. 3.8-64) of valuable farmed wetlands from the landscape and the DEIS' apparent conclusion that migratory bird populations can quickly adapt to a radically altered mosaic of fallowed fields and farmed wetlands seems flawed and not supported by scientific documentation. Furthermore, the DEIS appears to incorrectly assume that all other factors will be held equal while cropland idling and water transfers take place. This is not the case. The critically-dry 58
water years in which the maximum amount of water transfers are likely to take place are also the years when Delta farmers are most likely to fallow their lands, either voluntarily or due to water shortage, and these outcomes could greatly compound the adverse effects of the proposed project. For instance, the California Rice Commission reports that while farmers flood between 150,000 and 350,000 acres of ricelands annually in the Southern Sacramento Valley and Delta, farmers planted ~20% fewer acres during 2014 and may flood as little as 50,000 acres of ricelands in the 2014-2015 season due to the ongoing drought and water shortages.[18]

> ***Recommendations***: The FEIS should thoroughly characterize the potential reduction in resting and forage habitat for migratory bird species resulting from cropland idling and crop shifting. The FEIS should consider these potential impacts in the context of current trends regarding 59
> habitat availability and anticipated future conditions resulting from climate change and changes in farming practices. The FEIS should discuss means for ensuring that sufficient wetted habitat (natural wetland or flooded field) is available for migrating bird species.

Riparian Communities

The project has the potential to have significant adverse effects on riparian systems, but the DEIS discounts these potential effects, in part because "changes in stream flow attributable to the Proposed Action would fall within historical ranges" (page 3.8-52). It should be recognized, however, that water management practices administered by federal and State agencies and local irrigation districts have already caused great stress on riparian systems and their associated fish and wildlife species. Recent consumptive patterns involving surface water diversions and groundwater pumping have, in effect, simulated, for fish and wildlife, severe and prolonged drought conditions whether or not drought 60
conditions are actually present. The shift in hydrological conditions has caused a shift in species composition as native fishes have been overwhelmed and replaced by introduced and invasive aquatic species. Additional stress on these aquatic ecosystems could reinforce these adverse effects and potentially cause permanent, unmitigable impacts. The DEIS identified impacts to Cache, Stony, Coon, and Little Chico creeks that would be significant, with Little Chico Creek going to zero flow under some project scenarios. By their nature, no-flow conditions can lead to long-term and irreplaceable losses of ecosystem function.

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[18] "Wintering Waterfowl Habitat Concerns Looms Large," California Rice Commission, September 16 2014, http://calrice.org/blog/?id=1410890340&author=California+Rice+Commission

Recommendation: Revise the EIS to more accurately characterize potential impacts to riparian communities. Identify robust mitigation measures that would ensure that the proposed project 61 would not diminish instream flows in waterbodies affected by the proposed project.

The DEIS identifies GW-1 as a mitigation measure for off-setting the potential adverse effects on stream flows from groundwater substitution, but the proposed measure may not provide full compensation for the potential significant adverse effects on riparian systems. Based on the information provided in the DEIS, it appears that the proposed project does not contain provisions for preventing the complete dewatering of smaller streams near groundwater pumping zones. As mitigation measure GW-1 is 62 designed to be reactionary, dewatered stream conditions might persist for extended periods before natural recharge to aquifers could restore base flows. This could result in serious indirect costs, such as the loss of mature riparian vegetation essential to the structure and function of riparian systems. Even if measures are taken to restore the riparian forest, the genetic losses could be permanent and full restoration may not be possible.

Recommendations: Revise measure GW-1 to address potentially irreversible adverse effects to riparian systems and related habitats from the implementation of the proposed project. Include, in the proposed monitoring plan, monitoring of any small tributary streams near the point of 63 groundwater extraction. We recommend that specific mitigation triggers be established identifying the percent reduction in flow outside the natural range that would require a cessation of pumping.

Range of Alternatives

In the development of project alternatives, BOR employed a screening criterion that all alternatives must be immediate, flexible, and provide new water to the buyers' service area. The requirement that all project alternatives provide water was used to screen out potential project components involving the conservation or transfer of water within the seller service area (Table 2-1). It is unclear why this screening criterion was deemed necessary and how it relates to the project "need" of immediately implementable and flexible water supplies to alleviate shortages (p. 1-2). The restriction imposed that 64 the alternatives need to "provide water" screens out all alternatives that would promote reducing demand in the buyer area and having water rights holders operate within the limits of their existing legal water rights. Some of the alternatives screened out by this criterion might be found to be environmentally and economically preferable. For example, retirement of drainage impaired areas that leach selenium into the San Joaquin River has been documented to have environmental and economic benefits in a National Economic Development Analysis conducted as part of the San Luis Drainage Feature Re-evaluation FEIS.[19] It is unclear why within basin transfers in the buyers service area, considered in conjunction with demand reducing measures, such as conservation and land fallowing, would not meet the underlying project need to supply water to meet shortages. It is also unclear why groundwater storage ("Build new facilities to recharge and extract groundwater for use in buyer service area") in the buyers service area was deemed as not providing new water supply. If aquifers are recharged in wet years, then 65 that water is pumped and used in dry years, it seems this alternative would offer "new supply" in circumstances similar to those when pumping of groundwater from the seller's service area would enable groundwater substitution transfers.

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[19] San Luis Drainage Feature Re-evaluation Final EIS (2007) available at: http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=61

***Recommendation*:** Explain how the screening criteria were developed and why the requirement that a project component provide new water was deemed appropriate and necessary. A number of the measures eliminated from further consideration in Table 2-1 warrant further consideration and discussion. The FEIS should explain why measures to limit demand and enable within basin exchange of water in the buyers service area, considered in conjunction with one another, would not meet the screening criteria identified. 66

State of California – Natural Resources Agency
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EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

SA01

December 1, 2014

Frances Mizuno
Assistance Executive Director
San Luis & Delta-Mendota Water Authority
842 6th Street
Los Banos, CA 93635

Dear Mr. Mizuno:

LONG-TERM WATER TRANSFERS ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT; SCH NO. 2011011010

The California Department of Fish and Wildlife (CDFW) has reviewed the Bureau of Reclamation and San Luis & Delta-Mendota Water Authority (SLDMWA) Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Long-Term Water Transfers Project (Project). Thank you for providing CDFW the opportunity to address its area of statutory responsibility in the EIS/EIR (Cal. Code Regs., tit. 14, §§ 15086 & 15088).

The goal of the Project is to reduce Central Valley Project (CVP) supply shortages caused by dry hydrologic years by transferring water from entities upstream from the Sacramento-San Joaquin Delta to SLDWMA Participating Members and other CVP water contractors south of the Delta. Water would be made available for transfer through groundwater substitution, cropland idling, crop shifting, reservoir release, and conservation. The EIS/EIR evaluates potential impacts of water transfers over a 10-year period, 2015 through 2024. 1

<u>CEQA Role</u>

CDFW is a Trustee Agency as defined in the Guidelines for the Implementation of the California Environmental Quality Act (Cal. Code Regs., tit. 14, § 15000 et seq.; hereafter CEQA Guidelines) with responsibility for commenting on projects that could affect fish and wildlife resources (CEQA Guidelines, § 15386). CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species (i.e., biological resources). As a Trustee Agency, CDFW is responsible for providing, as available, biological expertise to review and comment upon environmental documents and impacts arising from project activities, as those terms are used under CEQA (Fish & G. Code, § 1802).

CDFW anticipates that it may use the final EIS/EIR and act as a Responsible Agency as part of possible future consideration and issuance of discretionary approvals, described below.

Discretionary Approvals

State Threatened, Endangered, and Candidate Species: CDFW has discretionary authority over activities that could result in the "take" of any species listed as candidate, threatened, or endangered pursuant to the California Endangered Species Act (CESA; Fish & G. Code, § 2050 et seq.). CDFW considers most adverse impacts on CESA-listed species, for the purposes of CEQA, to be significant without mitigation. Take of any CESA-listed species is prohibited except as authorized by state law (Fish & G. Code, §§ 2080 & 2085). Consequently, if Project activities result in take of CESA-listed species, CDFW recommends that the Project proponent seek appropriate authorization prior to Project implementation. This may include an incidental take permit (ITP) or a consistency determination in certain circumstances (Fish & G. Code, §§ 2080.1 & 2081 subd. (b)). 1

Rivers, Lakes, and Streams: An entity may not: substantially divert or obstruct the natural flow of; substantially change or use any material from the bed, channel, or bank of; or dispose of any debris, waste, or other material into, any river, stream, or lake unless certain conditions are met. For such activities, the entity must provide written notification to CDFW. Based on the written notification and site specific conditions, CDFW will determine if the activity may substantially adversely affect an existing fish or wildlife resource and issue a Lake or Streambed Alteration (LSA) Agreement to the entity that includes reasonable measures necessary to protect the resource (Fish & G. Code, § 1600 et seq.).

Note that CDFW must comply with CEQA prior to issuance of an ITP or LSA Agreement for a project. As such, CDFW may consider the Lead Agency's CEQA documentation for the project. To minimize additional requirements by CDFW and/or under CEQA, the final EIR should fully disclose potential Project impacts on CESA-listed species and any river, lake, or stream, and provide adequate avoidance, minimization, mitigation, monitoring and reporting measures for issuance of an ITP or LSA agreement.

COMMENTS AND RECOMMENDATIONS

Project Description

Section ES.2.2, Page ES-6, Table ES-2:

The EIS/EIR states that Merced Irrigation District (ID) is a Potential Seller of 30,000 ac-ft of water. However, Merced ID is seeking a new license from the Federal Energy Regulatory Commission (FERC) for continued operation of the Merced River Hydroelectric Project, and in July 2014, CDFW submitted to FERC recommended mitigation measures for the new license, including significant changes to instream flow releases and reservoir operations. In September 2014, Merced ID responded to CDFW's recommendations in a document filed with FERC as part of the FERC Project No. 2179 administrative record titled, "Merced ID's Reply to Comments, Recommendations, Preliminary Terms and Conditions, and Preliminary Fishway Prescriptions." On pages 106-107 of this document, Merced ID predicted that compliance with CDFW flow recommendations "increases the average annual water supply shortage by more than 100,000 ac-ft and creates shortages in most year types. [CDFW's] recommendation reduces average annual carryover capacity storage by...73,000 ac-ft compared to the Merced ID's Proposed Project." Analogous recommendations by the U.S. Fish and Wildlife Service (USFWS) and other agencies to modify flow releases and reservoir operations received similar responses from Merced ID, all indicating significant water supply shortages and reduced carryover volumes if the recommended mitigation measures were implemented. There appears to be a substantive disconnect between these kinds of water supply evaluations in the FERC administrative record and the Project EIS/EIR which lists Merced ID as a willing seller of up to 30,000 ac-ft annually. 2

CDFW recommends that the EIS/EIR scope reference the ongoing FERC relicensing and incorporate the water supply and carryover volume analyses submitted by Merced ID to FERC. A Draft Environmental Impact Statement prepared by FERC for Merced ID's Hydroelectric Project is estimated to be issued in March 2015 and finalized in August 2015.

Section ES.3.2, Page ES-9, Table ES-3:

This section states, "[i]n the No Action/No Project Alternative the Buyer Service Area would experience shortages and could increase groundwater pumping, idle cropland, or retire land to address those shortages." However, this may not be an accurate description of this alternative because the Buyer Service Area currently utilizes short-term transfers to address their water needs. Further, due to existing transfers, the Central Valley Project Improvement Act Refuge Water Supply Program, which maintains and improves wetland habitat areas, is currently experiencing water transfer 3 capacity issues concerning its already limited water supply, even without implementation of the Project. For example, this year at the Volta Wildlife Area, the last known population of giant garter snake *(Thamnophis giga*, GGS) in the western San Joaquin Valley was threatened with incidental take pursuant to CESA due to surface water supply limitations and likely operational constraints of conveyance systems needed to provide water needed for habitat. Cumulative impacts from short-term transfers and long term transfers proposed by the Project may have a significant impact on fish and wildlife that utilize refuges by resulting in a substantial adverse impact on sensitive species or interfering substantially with the movement of native migratory species. 3

CDFW recommends that that EIS/EIR describe the relationship between the existing short-term water transfers and long term transfers proposed by the Project, including an analysis of cumulative impacts from these activities, and any potentially significant impacts on fish and wildlife resources. Mitigation should be proposed if warranted.

<u>Environmental Setting</u>

Section 2.3.2.4, Page 2-30:

This section references, but does not clearly define, "protected aquatic habitats." Project activities could result in substantial adverse impacts on aquatic habitats that are not clearly designated as "protected aquatic habitats."

CDFW recommends that the EIS/EIR expand the definition of "protected aquatic habitats" to include public lands under conservation easement, State wildlife areas and ecological reserves, federal refuges, and private managed wetlands because management efforts to protect GGS occur on these lands. Also identify how and to whom the seller will demonstrate that any impacts to special-status species have been addressed, including through coordination with CDFW and USFWS. 4

Section 2.3.2.4, Page 2-30:

This section states that the determination of Priority GGS habitat will be made through coordination with GGS experts, Geographic Information System (GIS) analysis of habitat proximity to historic tule (*Schoenoplectus* sp.) marsh, and GIS analysis of suitable habitat. However, this may not be sufficient to ensure appropriate identification of GGS habitat or areas that should be "prioritized" for species conservation. This could result in a substantial adverse impact on the species should appropriate habitat be overlooked. 5

CDFW recommends that the EIS/EIR state that consultation with CDFW and USFWS is required to ensure appropriate identification of GGS habitat and to evaluate which fields

to fallow, through review of the CDFW's California Natural Diversity Database 5
(CNDDB), review of rice fields which will be in production, and fallowing away from canals in a patchwork fashion to maximize habitat connectivity.

Section 2.4, Page 2-41, Table 2.9:

This table states that use of transfer water in the Buyer Service Area may result in increased irrigation on drainage impaired lands in the Buyer Service Area which could affect water quality, but that this impact is less than significant. However, significant environmental damage to fish and wildlife resources has occurred in the past from 6
discharge of drainage from impaired lands. Many federal, state, and private managed wetland areas in the Central Valley are located at the lower end of watershed drainage areas and receive irrigation return flows as part of their water supply.

CDFW recommends the EIS/EIR analyze potentially significant impacts from increased irrigation on drainage impaired lands on Central Valley managed wetland public trust fish and wildlife resources.

Table 2.9 of this section states that cropland idling/shifting could alter the amount of suitable habitat for natural communities and special-status wildlife species associated with seasonally flooded agriculture and associated irrigation waterways. This impact is identified as less than significant. However, cropland idling/shifting could have a significant impact on habitat availability for shorebirds, resident and migratory waterfowl, and special-status species in the Central Valley, especially if shifting reduces the amount of seasonally flooded post-harvest rice and corn. Seasonal flooding of post-harvest rice and corn provides a substantial percentage of habitat and food supplies for 7
migratory waterfowl. The 2006 Central Valley Joint Venture Implementation Plan estimates that 170,000 acres of post-harvest rice is needed for wintering waterfowl and wintering shorebirds in order to meet bird conservation goals.

CDFW recommends that the EIS/EIR address potentially significant impacts of cropland/idling shifting on fish and wildlife resources. Impacts could be mitigated if buyers of transfer water created equivalent habitat or habitat values to those that would be lost.

Section 3.1.2.1, Page 3.1-14:

SACFEM2013 was used to model streamflow depletion from groundwater substitutions. 8
Outputs from this model were used in a post-processing tool to simulate transfers and delta exports in order to analyze potential impacts to surface water supplies. However, it is unclear why monitoring data collected from 2007-2010 transfers were not used to support the models.

CDFW recommends that the EIS/EIR explain what type of data (i.e., surface flow depletions from groundwater substitution pumping) were collected by the Sellers from all years that transfers took place, and specifically from the recent four consecutive years of transfers (2007-2010). The document should discuss why these data were not used in the analysis of impacts to streamflow from groundwater substitution pumping. 8

Section 3.3.4.1, Page 3.3-88 to 3.3-91:

Groundwater substitution transfers can create time delays between additional groundwater pumping and potential impacts on stream systems. These delays may have significant impacts on timing and availability of surface flow to resident and anadromous fish species, special status species, and other fish and wildlife resources. 9
The Department of Water Resources has been studying stream flow depletions as they relate to Sacramento Valley groundwater substitution transfers for several years.

CDFW recommends that the EIS/EIR include the results of the Department of Water Resources studies and analyze potential impacts on fish and wildlife resources resulting from time delays.

Section 3.7.1.3.2, Page 3.7-9:

This section lists the names of five creeks where no sampling information is available to indicate the presence of special-status fish species. Presence was assumed and further biological analyses were conducted in these waterways. However, this section inconsistently lists four of the five same creeks (along with 15 others) and states that a 10
review of field sampling data and reports indicates that there is no evidence of the presence of special-status fish species in these waterways and, as a result, no further biological analysis was conducted.

CDFW recommends that the EIS/EIR clarify whether these five creeks may support special-status fish species.

Section 3.8, Page 3.8-20, Table 3.8-1:

The EIS/EIR includes western pond turtle (*Actinemys marmorata*, WPT) as a "listed" species. However, WPT is a Species of Special Concern (SSC), and is not CESA-listed or listed under the federal Endangered Species Act. Pacific pond turtle is used 11
throughout the EIS/EIR in reference to WPT.

CDFW recommends that WPT be described as an SSC and moved to the following rows that describe SSC in Table 3.8-1. The species should be consistently referred to as "western pond turtle (WPT)" throughout the EIS/EIR.

Impacts

Section 1.3.2.4, Page 1-14:

This section addresses impacts on fish and wildlife resources, and states that Water Code sections 1725 and 1736 require the State Water Resources Control Board to make a finding that proposed transfers would not result in unreasonable impacts on fish and wildlife or other instream beneficial uses prior to approving a change in post-1914 water rights.

CDFW recommends adding the following information is to Section 1.3.2.4 for regulatory consistency and clarity: California Code of Regulations Title 23 section 794 requires the petitioner to 1) provide information identifying any effects of the proposed changes on fish, wildlife, and other instream beneficial uses, and 2) request consultation with CDFW and the Regional Water Quality Control Board regarding potential effects of the proposed changes on water quality, fish, wildlife and other in stream beneficial uses. The petition for change will not be accepted by the State Water Resources Control Board unless it contains the required information and consultation request. Early communication with CDFW would streamline the consultation process through "up front" coordination regarding assessment of the potential impact to fish and wildlife resources. The State Water Resources Control Board will use this information in making their finding that proposed transfers do not result in unreasonable impacts on fish and wildlife or other instream beneficial uses 12

Section 2.3.2.1, Page 2-10:

CDFW recommends that the EIS/EIR clarify if water transferred via forbearance agreements were analyzed as part of the Project. If not, impacts from potential increases in groundwater pumping by seller agencies forbearing CVP water should be analyzed as a reasonably foreseeable future action/probable future project in the cumulative impacts analysis of each section. 13

Section 2.3.2.4, Page 2-29 to 2-30:

It is common for CDFW to review proposed water transfer CEQA documents, typically Negative Declarations, which do not address Environmental Commitments. Data may not be available to support the transfer request relative to potential impacts to fish and wildlife. 14

CDFW recommends that all proposed water transfers address Environmental Commitments and potential impacts on fish and wildlife. Include analysis of any previous transfers, monitoring, and mitigation efforts, and identification of how much water was actually transferred in previous years. Annual review of mapped acreage, diverted acre feet of water and monitoring and reporting results would provide a basis to develop baseline information on potential impacts of future proposed transfers.

This section states that Bureau of Reclamation would provide maps to USFWS in June of each year showing the parcels of riceland that are idled for the purpose of transferring water for that year. 14

CDFW recommends that the EIS/EIR state that these maps would also be provided to CDFW and the GGS interagency management team in order to provide coordination for conservation and management of Central Valley GGS populations.

Section 3.7.1.3.3, Page 3.7-15:

Summer rearing of Central Valley steelhead would overlap with water transfers occurring in the Seller Service Area (July-September), both in the Sacramento and San Joaquin River and their tributaries. Thus, water transfers have the potential to impact steelhead. The majority of rearing, however, would occur in the cooler sections of rivers and creeks above the influence for the transfers. Earlier in the Draft EIS/EIR, it is stated that water made available from groundwater substitution transfers may start as early as April (Page 2-10). 15

CDFW recommends that the EIS/EIR clarify when groundwater substitution transfers could begin and, if necessary, analyze impacts on Central Valley steelhead that may be impacted by groundwater transfers occurring in April, May and June.

Section 3.7.2.1.3, Page 3.7-20:

For smaller tributaries, the impact analysis compared modeled groundwater depletion flow rates to available data on mean flow rates for the historical period of record and identified changes to these monthly average flow rates that would result from water transfer actions. Significant impacts on fisheries resources due to stream flow depletions are more likely to occur during low-flow periods of any given month. 16

CDFW recommends that the EIS/EIR analyze the impacts from groundwater pumping on the low-flow period of each month, rather than the average stream flow for the entire month, in order to determine the significance of impacts on fisheries resources and special-status fish species during this sensitive period.

This section states that development of the impact analysis involved literature review, review of known occurrences of special-status species based on the CNDDB, USFWS regional species lists, information from National Oceanic and Atmospheric Association fisheries website, and results of hydrologic modeling. 17

CDFW recommends that the EIS/EIR also include a discussion of how monitoring plans and monitoring data from previous years were used to show that transfers did not 17 adversely affect fisheries resources.

This section states that historical stream flow information for small streams were gathered where available and used as the measure of baseline flow. For locations for which historical flow data were limited or unavailable, a qualitative discussion of potential impacts is included for these locations. 18

CDFW recommends that the EIS/EIR include a table or an appendix to show which streams used available historic flow data, what this data included, and which streams lacked historic data and were subject to a qualitative analysis. This information will guide where additional stream flow efforts are needed relative to fisheries resource needs.

Section 3.7.2.4.1, Page 3.7-26 - 3.7-27:

Eastside/Cross Canal and Salt Creek have the potential for impacts on special-status fish species due to flow reductions, although no data were available to determine the proportional reduction in base flows (i.e., if a greater than 10 percent reduction would occur). This section states that these waterways are 1) "generally" not immediately adjacent to groundwater substitution transfers; 2) other "nearby" small waterways are not experiencing flow decreases that are causing significant impacts to aquatic resources; and 3) flow reductions would be observed at monitoring wells in the region and any adverse effects would be mitigated by implementation of Mitigation Measure GW-1. The mitigation plan would include curtailment of the pumping until natural recharge corrects the environmental impact. Therefore, the impacts on fisheries resources would be less than significant. However, it is unclear what the trigger for pumping curtailment would be and how cessation of pumping to allow natural recharge 19 to "correct the environmental impact" mitigates this impact to a less than significant level if the impact has already occurred.

CDFW recommends that the EIS/EIR define "generally not immediately adjacent," explain how the determination was made that other "nearby" small waterways are not experiencing flow decreases that are impacting aquatic resources, and how these surrogate waterways relate to the potentially impacted streams. Additionally, the EIS/EIR should identify 1) how the placement and use of monitoring wells would be able to observe instream flow reductions, 2) how the trigger for curtailment of pumping that causes an adverse impact was derived, and 3) if the time from observation of streamflow reductions that result in adverse impacts to the cessation of groundwater pumping would be responsive enough to mitigate for impacts (Barlow and Leake 2012). This recommendation also applies to Section 3.7.6.1.1, which analyzes the cumulative impacts on fisheries resources and special-status fish species in Cache Creek, Stony

Creek, Coon Creek, Little Chico Creek, Bear River, Eastside/Cross Canal and Salt Creek and Section 3.8.2.4.1, which analyzes the effects of substantially reduced stream flows as a result of groundwater substitution pumping on the riparian natural communities in Cache and Stony Creeks. 19

This section lists 21 waterways where the Project would have a less than significant impact on fisheries resources and special-status fish species. The basis for this determination is that modeled flow changes would be small and no substantial effect on water quality would result from implementing the Proposed Action.

CDFW recommends that "water quality" in the previous sentence be replaced with "fisheries resources" and tables similar to Tables 3.8-5 and 3.8-7, which show the average monthly flow by water year type in Cache Creek and Stony Creek, respectively, under the No Action/No Project alternative (using historical data) and the Project (using the groundwater model's prediction of reduced flows from the Proposed Action), be included for all streams that have the potential to be impacted by the Proposed Action. As stated above, CDFW recommends that the analysis of potential impacts from groundwater pumping use data from the low-flow period of each month, rather than the average stream flow for the entire month, to determine the significance of impacts to fisheries resources and special-status fish species during this sensitive period. 20

Section 3.7.2.4.1, Pages 3.7-28 to 3.7-29:

This section states that due to incomplete baseline flow data, modeling results were compared to only three years (2003-2005) of existing stream gage data for Coon Creek, indicating that there would be one water year in one month in which flows could potentially be reduced by more than 10 percent. This modeled reduction to baseline flows is stated to be a "worst case scenario" because flows used in this calculation are at the low end (20 cfs) of existing flow data range (20-40 cfs). Modeling shows that flows in all other months and water year types would be reduced by less than 10 percent of baseline flows and, therefore, impacts on fisheries resources would be less than significant. Omitted from this analysis is that the Water Year types for 2003, 2004 and 2005 were categorized as above normal, below normal, and above normal, respectively. It is unclear how this analysis of reductions is considered a "worst case scenario" if the low end of the baseline flow data range (20 cfs) was observed in either an above normal or below normal water year. Regardless of available gage data, it is rational to expect lower flows in Coon Creek in a dry or critically dry year, which would result in the Project reducing baseline flows by more than 10 percent. 21

CDFW recommends that the EIS/EIR explain how stream gage data taken from only above normal and below normal water years, which is then used as baseline flows for comparing to model results, captures the full extent of the potential impacts to fisheries resources in Coon Creek that may occur in dry or critically dry years. This explanation should also be included for impacts on natural communities and wildlife species habitat (Page 3.8-59). 21

This section states that pursuant to model results, Little Chico Creek flows would be reduced by more than 10 percent in multiple water year types from July to October. Although this reduction could be as much as 100 percent of instream flows, the Project would not have a substantial impact on fisheries resources. The reason being that it's not uncommon for natural flows to be very low during these months (0.5 cfs and below), which causes an increase in temperature and reduced dissolved oxygen levels intolerable for over-summering adult spring-run Chinook salmon, so the fish would not be present anyway. Also, depletions from groundwater pumping would cause levels to be within the flow range normally experienced by any juvenile steelhead and hardhead species have experienced low-to-no flows in the past, project impacts that reduce flows to this level would not harm them. 22

CDFW recommends that the EIS/EIR analysis focus on the impacts that low flow periods in Little Chico Creek have on special-status fish species and fisheries resources in general, what an increase to the frequency of these low flow events caused by the Project means to these species, and how do the periods were the Project completely dewaters the creek (i.e., reductions of "up to 100 percent of instream flows") affect stream connectivity, species movement, and the overall health of the species.

Section 3.8.2, Page 3.8-35:

This section states that the distribution of water year types within the action period is unknown. Additionally, the exact locations of cropland idling/shifting actions would not be known until the spring of each year, when water acquisition decisions are made. The contribution to instream flows from agricultural return flows would be reduced in areas where cropland idling occurs. However it is unclear how this reduction was accounted for in the analysis of impacts on fish and wildlife resources and instream flows if the locations are unknown at this time. 23

CDFW recommends that the EIS/EIR explain how reduced agricultural return flows due to cropland idling/shifting were factored into the impact analysis.

Section 3.8.2.1.4 Page 3.8-38 to 3.8-40:

This section states that the magnitude and frequency of streamflow depletion in small streams were derived from a groundwater model (SACFEM2013) and then used to evaluate potential impacts to natural communities and special status vegetation and wildlife, since Central Valley Project and State Water Project operations could not be altered to offset any changes in small streams. However, the impacts of groundwater substitution on larger rivers and Central Valley Project/State Water Project reservoirs 24

are carried from the groundwater model to the transfer operations model, which incorporates other changes in hydrology associated with cropland idling/shifting, reservoir releases and water conservations. This implies that changes in small stream
hydrology associated with cropland idling/shifting were not included in the 24
SACFEM2013 model.

CDFW recommends that the EIS/EIR explain how reduced agricultural return flows in small streams were accounted for in the SACFEM2013 groundwater model.

Section 3.8.2.4.1, Page 3.8-47:

This section describes impacts on natural communities in shallow groundwater areas in the North Delta; however it does not address impacts on wildlife. Some sensitive wildlife
species require shallowly flooded areas (e.g., GGS and WPT) and impacts on these 25
areas may substantially adversely affect such species.

CDFW recommends that the impact analysis not be solely based on whether vegetation will change. In shallowly flooded areas, a reduction of groundwater that lowers surface water elevation of wetlands should also be described, and impacts on wildlife that rely on shallow water analyzed. Mitigation should be provided if warranted.

In this section, the Assessment/Evaluation Methods for groundwater substitution transfers states that potential impacts of groundwater substitution on natural communities in upland areas was considered potentially significant if it resulted in a consistent, sustained depletion of water levels that were accessible to overlying communities (groundwater depth under existing conditions was 15 feet or less). A sustained depletion would be considered to have occurred if the basin did not recharge from one year to the next (Page 3.8-33). In a few locations in the North Delta associated with wetlands, groundwater elevations under existing conditions are less than 15 feet below ground surface and natural communities reliant on groundwater are more likely to
be impacted. In these areas, the maximum reductions would be 0.3 to 0.8 feet, with full 26
recharge. The Project would have a less than significant effect on natural communities and special-status plants because increases in drawdown would be too small to cause a substantial effect on vegetation that relies on groundwater. However, the EIS/EIR doesn't identify where these "few locations in the North Delta" are located or the natural communities that occur in these areas. Also, the less than significant determination is based upon the assertion that full recharge of the groundwater basin would always occur, thus only reducing groundwater levels by a maximum of 0.3-0.8 feet.

CDFW recommends that the EIS/EIR identify and discuss the areas in the North Delta and the natural communities associated with those areas in greater detail. Since the less than significant determination is based upon the assertion that full recharge of the groundwater basin will always occur, thus resulting in a max reduction of 0.3-0.8 feet (too small to cause substantial effects), supporting historic groundwater elevation data should be provided. 26

Section 3.8.2.4.1, Page 3.8-60:

For Little Chico Creek, this section states, "[b]ecause flow reductions would be small and only during months when the creek is essentially dry, changes in stream flow would not substantially reduce natural communities or wildlife species habitat." However, taking water from a creek that is nearly dry could result in significant impacts on wildlife because some animals may not be able to tolerate prolonged episodes of dryness (e.g., WPT). 27

CDFW recommends that the EIS/EIR include an analysis of how the reduction of water during already dry times does not substantially reduce the availability of habitat for, or movement ability of, sensitive species.

Appendix I, Table I-1:

The Project proposes to fallow alfalfa and other row crops which Swainson's hawks (*Buteo swainsoni,* "SWHA"), a State-listed species, utilize to forage. However, the EIS/EIR does not disclose which croplands within foraging distance of SWHA nest trees will be fallowed, or the composition of these areas. Long term fallowing of these fields may result in a change or loss of pray base, prompting SWHA to leave the nest tree for longer periods to forage in other areas, which could negatively affect the species' reproductive effort. Therefore, the long term loss of foraging habitat could result in significant impacts on nesting SWHA by substantially reducing the number of an endangered, rare, or threatened species, and/or substantially adversely affecting a special status species (CEQA Guidelines, §15065 & Appendix G). 28

CDFW recommends that the EIS/EIR disclose which croplands in foraging distance of SWHA nest trees would be fallowed and the composition of these areas, analyze whether resultant impacts on SWHA could be significant, and provide for mitigation if warranted.

General:

Bureau of Reclamation contracts for Central Valley Project Improvement Act (CVPIA) Refuge Water Supply (RWS) delivery to USFWS, CDFW, and Grassland Water District managed wetlands all contain language in Article 7 allowing Project Water to be transferred, reallocated or exchanged to other refuges. CVPIA section 3406 subdivision (b)(3) requires development and implementation of a program to identify how the Secretary intends to utilize improvements in or modifications of project operation, including transfers, to fulfill the Secretary's obligations to deliver RWS. 29

CDFW recommends that the EIS/EIR identify the total amount of RWS available from all
sources north of Delta, and how these transfers are integrated into project operation.
The program should address annual and long-term water transfer impacts that may
adversely affect managed wetland water supply including endangered species recovery
needs at managed wetlands; lack of sufficient dedicated water storage; timing of water 29
delivery and use on shared conveyance systems; and potential increased groundwater
use. CDFW is available to assist Bureau of Reclamation with any and all efforts to
maximize use of water transfers in the furtherance of overall CVPIA RWS program
objectives. These efforts should be coordinated with USFWS, Grassland Water District,
and the Central Valley Joint Venture.

<u>Mitigation Measures</u>

Section 2.3.2.4, Pages 2-29 to 2-30:

Much of this section involves Environmental Commitments to protect GGS. These same commitments were largely used for 2014 transfers, and to a lesser degree, in previous years. Efforts to develop and refine the Environmental Commitments are ongoing, and studies to better understand GGS life history and distribution continue.

CDFW recommends incorporating any monitoring and analysis available from 2014 and 30
previous transfer years where these and similar commitments were in place, and
adaptively incorporating feedback as more information becomes available each year,
including drought year impacts, as well as the following: incorporate results from
ongoing studies on GGS population dynamics and distribution analysis; continue
development of a long-term strategy and research framework; continue interagency
coordinated efforts and investigate partnerships with water districts, non-governmental
organizations, and academia; and include coordinated and collaborative development,
including CDFW, to address GGS long-term conservation needs.

Section 3.1.4.1, Page 3.1-21:

This section states that a streamflow depletion factor (SDF) would be applied to mitigate
potential water supply impacts from additional groundwater pumping due to
groundwater substitution transfers. This is intended to offset the streamflow effects of
the added groundwater pumping. The exact percentage of the SDF would be
determined based on hydrologic conditions, groundwater and surface water modeling, 31
monitoring information, and past transfer data. However, it is unclear what monitoring
information and past transfer data has shown, and if previous percentages been
adequate to mitigate for impacts.

CDFW recommends that the EIS/EIR include information on previous monitoring efforts; for example, what they entailed, past transfer data, the type of post-transfer analysis that was done, and what this analysis showed with respect to impacts on streamflow from increased groundwater pumping. 31

Section 3.3.4, Pages 3.3-88 to 3.3-91:

It is unclear whether mitigation measure GW-1 "Monitoring Program and Mitigation Plans" would reduce impacts on wildlife to less than significant because it appears that only wells would be monitored (as opposed to streams, wetlands, or sensitive species), and that impacts to wildlife would be reported by an outside entity. Monitoring would be coordinated with well operators and "other decision makers." The section states that if the seller's monitoring efforts indicate that the operation of wells for groundwater substitution pumping are causing substantial adverse impacts, the seller will be responsible for mitigating any significant environmental impacts that occur. However, it is unclear how this determination would be made. 32

CDFW recommends that the EIS/EIR analyze the need for monitoring of other water features and resources and include discussion of the types of monitoring and mitigation efforts conducted for past transfers, what will be duplicated for the Proposed Project, and any new/revised activities to ensure impacts on fish and wildlife resources are reduced to less than significant. The EIS/EIR should clarify who the "other decision makers" are and include representatives from CDFW and USFWS. Mitigation should also state that CDFW and USFWS would have authority to deem a monitoring and mitigation plan adequate or not for the purposes of issuing a water transfer agreement. The EIS/EIR should identify an entity with appropriate expertise to determine if Project activities are resulting in substantially adverse impacts and an adequate level of mitigation.

There are several EIS/EIR sections that conclude impacts on wildlife would be reduced to less than significant levels based on implementation of mitigation measure GW-1, which is intended to take corrective actions once substantial adverse impacts have been identified. However, these impacts appear to be based almost exclusively on changes in vegetation, which are not necessarily appropriate proxies for wildlife populations. Animals may starve or be exposed to greater predation well before signs of substantial impacts on riparian and wetland vegetation become evident. In addition, because there is no requirement for monitoring of vegetation changes, those signs would apparently have to be identified by agencies and organizations outside of the water transfers; therefore, there are no assurances they would be identified. Further, increases in flows are not always beneficial. For example, if flows are over 200 percent of normal during summer months, WPT nests could be flooded out, significantly reducing recruitment. 33

CDFW recommends that the EIS/EIR include a more comprehensive approach to evaluating impacts on fish and wildlife based on the habitat components required by each affected species including, but not limited to, plant community requirements. Mitigation should be proposed if warranted. 33

This section states the objectives of the monitoring and mitigation plan. However, these objectives are not fully consistent with the Draft Technical Information for Preparing Water Transfer Proposals (Bureau of Reclamation and Department of Water Resources 2013) and Addendum (Bureau of Reclamation and Department of Water Resources 2014). 34

CDFW recommends that the above statement be consistent with the specific mitigation and monitoring requirements of the aforementioned Draft Technical Information for Preparing Water Transfer Proposals and Addendum.

This section states that water transfer proponents would provide a final summary report to Bureau of Reclamation evaluating the impacts of the water transfer. The final report would identify transfer-related impacts on groundwater and surface water during and after pumping. However, past water transfer activities could inform anticipated impacts on fish and wildlife resources. 35

CDFW recommends that the EIS/EIR include the impacts past reports have shown in order to inform analysis of future transfers regarding impacts on the environment, and to avoid or mitigate any significant effects of proposed transfers.

General:

Water Code section 1018 states that landowners "shall be encouraged" to cultivate or retain non irrigated cover crops or natural vegetation to benefit waterfowl, upland game bird, and other wildlife habitat. The Department of Water Resources is currently addressing guidance and implementation regarding this language. CDFW recommends incorporating this information into the EIS/EIR so those proposing transfers would be compliant with these provisions. 36

FUTURE COORDINATION

Questions regarding this letter or further coordination should be directed to Cathie Vouchilas, Environmental Program Manager, at (916) 651-1190 or Cathie.Vouchilas@wildlife.ca.gov.

Sincerely,

Helen Birss

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Branch Chief

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DELTA STEWARDSHIP COUNCIL

A California State Agency

December 1, 2014

Mr. Brad Hubbard
U.S. Bureau of Reclamation
Planning Division
2800 Cottage Way
MP-410
Sacramento, CA 95825

RE: Proposed Long-Term Water Transfers EIS/R

Dear Mr. Hubbard:

The Delta Stewardship Council (Council) welcomes the opportunity to comment on the Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/R) evaluating the potential impacts of alternatives to help address the Central Valley Project (CVP) water supply shortages (Project), being prepared jointly by the U.S. Bureau of Reclamation (Reclamation) and the San Luis & Delta-Mendota Water Authority (SLDMWA). The Council is an independent California state agency tasked with furthering California's coequal goals for the Delta through the implementation of the Delta Plan, a comprehensive, long-term Delta management plan. As defined in the California Water Code section 85054, the State's coequal goals include providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The Delta Plan highlights that north-to-south water transfers across the Delta can be an important tool for improving water supply reliability and includes several recommendations to identify and enhance opportunities for water transfers in furtherance of the coequal goals. The Plan also calls for improving water transfer procedures. 1

Even as the Council and Delta Plan support water transfers, they are only one important component for increasing water supply reliability and must be part of a larger suite of actions and projects. The Council has defined what the achievement of a more reliable water supply for California means:

(a) Better matching the state's demands for reasonable and beneficial uses of water to the available water supply. This will be done by promoting, improving, investing in, and implementing projects and programs that improve the resiliency of the state's water systems, increase water efficiency and conservation, increase water recycling and use of advanced water technologies, improve groundwater management, expand storage, and improve Delta conveyance and operations. The evaluation of progress toward improving reliability will take into account the inherent variability in water demands and supplies across California;

(b) Regions that use water from the Delta watershed will reduce their reliance on this water for reasonable and beneficial uses, and improve regional self-reliance, consistent with existing water rights and the State's area-of-origin statutes and Reasonable Use and Public Trust Doctrines. This will be done by improving, investing in, and implementing local and regional projects and programs that increase water conservation and efficiency, increase water recycling and use of advanced water technologies, expand storage, improve groundwater management, and enhance regional coordination of local and regional water supply development efforts; 1

(c) Water exported from the Delta will more closely match water supplies available to be exported, based on water year type and consistent with the coequal goal of protecting, restoring, and enhancing the Delta ecosystem. This will be done by improving conveyance in the Delta and expanding groundwater and surface storage both north and south of the Delta to optimize diversions in wet years when more water is available and conflicts with the ecosystem are less likely, and limit diversions in dry years when conflicts with the ecosystem are more likely. Delta water that is stored in wet years will be available for water users during dry years, when the limited amount of available water must remain in the Delta, making water deliveries more predictable and reliable. In addition, these improvements will decrease the vulnerability of Delta water supplies to disruption by natural disasters, such as, earthquakes, floods, and levee failures.

The 2009 legislation that created the Council also provided the Council with regulatory authority over certain types of activities undertaken by local or state agencies, called covered actions, and requires that covered actions be consistent with the Delta Plan as cited in Water Code section 85225 *"A state or local public agency that proposed to undertake a covered action, prior to initiating the implementation of that covered action, shall prepare a written certification of consistency with detailed findings as to whether the covered action is consistent with the Delta Plan and shall submit that certification to the council."* The Council developed new regulations governing covered actions, which became effective on September 1, 2013, and included them in the Delta Plan. The water transfers that are identified in EIS/R may be considered covered actions. Typically the lead CEQA agency determines if a proposed activity is a covered action and would then file a certification of consistency with the Council. The Council strongly encourages all state and local agencies who propose to approve, fund, or 2 carry out an action in the Delta, consult with the Council as early in the project's development as possible, to ensure the project is consistent with the Delta Plan. 2

The Council submits the following comments on the EIS/R:

- **The Council suggests that SLDMWA, on behalf of its participating member agencies as well as the Contra Costa Water District (CCWD) and East Bay Municipal Utility District (EBMUD), file a certification of consistency with the Council on the program of water transfers covered by this EIS/R and indicate in the EIS/R that these transfers are covered actions.** Water Code section 85057.5(a) defines a covered action as:

  …a plan, program, or project as defined pursuant to Section 21065 of the Public Resources Code that meets all of the following conditions:

  1. Will occur, in whole or in part, within the boundaries of the Delta or Suisun Marsh;
  2. Will be carried out, approved, or funded by the state or a local public agency;
  3. Is covered by one or more provisions of the Delta Plan;
  4. Will have a significant impact on the achievement of one or both of the coequal goals or the implementation of government-sponsored flood control programs to reduce risks to people, property, and state interests in the Delta. 3

  It appears that water transfers identified in the EIS/R meet the definition of a covered action. The preparation of the EIS/R indicates the Project meets the definition of a plan, program, or project as defined pursuant to Section 21065 of the Public Resources Code, the water transfers will take place at least partially in the Delta, will be undertaken by the participating agencies, will have a significant beneficial impact on water supply reliability, and implicate the following two regulatory policies that cover proposed water transfers through the Delta:

  WR P1 (23 CCR section 5003) - Reduce Reliance on the Delta through Improved Regional Water Self-Reliance. This policy covers a proposed action to export water from, transfer water through, or use water in the Delta

  WR P2 (23 CCR section 5004) – Transparency in Water Contracting. This policy covers:

  1. With regard to water from the State Water Project, a proposed action to enter into or amend a water supply or water transfer contract subject to California Department of Water Resources Guidelines 03-09 and/or 03-10 (each dated July 3, 2003), which are attached as Appendix 2A; and

2. With regard to water from the Central Valley Project, a proposed action to enter into or amend a water supply or water transfer contract subject to section 226 of P.L. 97-293, as amended or section 3405(a)(2)(B) of the Central Valley Project Improvement Act, Title XXXIV of Public Law 102-575, as amended, which are attached as Appendix 2B, and Rules and Regulations promulgated by the Secretary of the Interior to implement these laws. 3

- **The EIS/R should acknowledge the Delta Plan and its regulatory policies.** As previously discussed, the Council's regulations apply to covered actions where water suppliers export water from, transfer water through, or use water in the Delta; and covered actions that include entering into or amending water supply or water transfer contracts. Therefore, the Council, and its role with respect to covered actions, should be included in the appropriate sections of the EIS/R. 4

- **The EIS/R "Purpose and Need/Project Objectives" section of the EIS/R should include a quantitative assessment of the need for water transfers to help identify other possible reasonable alternatives.** CEQA requires the project objectives describe the underlying need for and purpose of the project. The EIS/R states the Project's objectives as:

  - Develop supplemental water supply for member agencies during times of CVP shortages to meet existing demands.
  - Meet the need of member agencies for a water supply that is immediately implementable and flexible and can respond to changes in hydrologic conditions and CVP allocations.

  However the EIS/R does not state what the water supply demand is for the participating agencies, nor does it state if that demand is changing over time, rather it merely identifies a list of potential buyers without any indication of the demands of those buyers. The EIS/R does describe how the member agencies' water supply from the CVP is variable, even with the use of water transfers. Table 1-1 indicates that the average CVP water supply allocation for the 2000 to 2014 period was 54% of contracted amounts for irrigation use and 83% of contracted amounts for municipal and industrial uses. Irrigation allocation was a full 100% only once during this period. Table 1-3 indicates that water transfers to SLDMWA member agencies occurred in 60% of the years between 2000 and 2014 though the amounts varied from several thousand acre-feet to over 169,000 acre-feet in 2009. 5

  Are the participating agencies' demands variable and able to adjust to a decrease in supply? Then potential alternatives to reduce demand in lieu of increasing supply should also be considered. Or are the participating agencies' water supply demands constrained only by their contracts and the ability of the federal and state projects to deliver water? Understanding the demand on the Delta as a water supply is important. It is California's policy to reduce reliance on the Delta in meeting California's future water supply needs through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency. Each region that depends on water from the Delta watershed shall improve its regional self-reliance for water through investment in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects, and improved regional coordination of local and regional water supply efforts (Water Code section 85021). 5

- **The EIS/R does not analyze the impacts of water transfers during periods when the state and federal water projects are unable to meet existing Delta water quality objectives.** In January 2014, Reclamation and the Department of Water Resources jointly filed a Temporary Urgency Change Petition (TUCP) for their water right permits and licenses for the state and federal water projects in response to extreme drought conditions in California. They requested temporary modification of requirements included in the State Water Resources Control Board's Revised Decision 1641; specifically the TUCP requested modifications to the requirement to meet the Delta Outflow Objective. The EIS/R does not analyze the potential impacts of water transfers on Water Quality (Chapter 3.2), Aquatic Resources (Chapter 3.7), Terrestrial Resources (Chapter 3.8), or any other potential Delta impact under these extreme conditions. Given that the current drought may continue into the period of time covered by the EIS/R and is likely to be a reoccurring event, the document should include an analysis of the impacts under extreme hydrologic conditions. 6

If you have any questions or would like to discuss the comments presented here, please feel free to contact me or my staff, Kevan Samsam at kevan.samsam@deltacouncil.ca.gov or (916) 445-5011. We look forward to engaging with Reclamation and its local partnering agencies on opportunities to further California's coequal goals and provide a more reliable water supply.

Sincerely,

Cindy Messer

Cindy Messer
Deputy Executive Officer

Cc: Frances Mizuno

SA03

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Water Boards

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GOVERNOR

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State Water Resources Control Board

December 1, 2014

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COMMENTS ON THE LONG-TERM TRANSFERS DRAFT ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

The State Water Resources Control Board (State Water Board) staff appreciates the opportunity to review and provide comments on the Long-Term Transfers Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Comments on the Draft EIS/EIR are due on December 1, 2014. State Water Board staff conducted an initial review of the Draft EIS/EIR. Upon further review, the State Water Board may have additional comments.

1

State Water Board staff's comments are focused on groundwater issues associated with this project given the significant emphasis of the proposed project on groundwater substitution transfers and the recent California groundwater legislation that the State Water Board will have a role in implementing, specifically the Sustainable Groundwater Management Act of 2014 (SGMA). The SGMA requires development of local groundwater sustainability agencies and plans in certain basins, including most of the region covered by the proposed project, and requires sustainable groundwater management within 20 years of plan adoption. The legislation also provides the State Water Board direct authority to intervene when a groundwater basin is not sustainably managed.

Numerous water interests have long-relied on water transfers from the Sacramento Valley to meet their water supply demands. These transfers are in part made possible by groundwater substitution, and are important to the agricultural economy and municipal water supply needs of California. These transfers can be a critical component of long-term supply strategies for some water users. However, over-reliance on groundwater substitution can result in serious adverse impacts where the groundwater pumping occurs, and can result in depletion of groundwater resources, ecosystem impacts, subsidence, and water quality degradation, specifically during times of drought.

2

The Draft EIS/EIR finds that potentially significant impacts to groundwater resources could occur, but that with the proposed monitoring and mitigation program in place, these impacts would be less than significant. However, it is not clear whether these determinations are supportable. Specifically, the Draft EIR/EIS appears to underestimate the impact of the proposed project on local groundwater, does not appear to adequately account for the effect of

3

current drought conditions on groundwater availability, and reaches conclusions that do not appear to be supported by the available data. Specific comments are provided below. 3

Comment #1: The Sustainable Groundwater Management Act
As mentioned above, California State Assembly Bill 1739 and Senate Bills 1168 and 1319 were passed by the Legislature in August 2014, and were signed into law by Governor Brown in September 2014. The package of bills constitutes the SGMA of 2014. The SGMA provides a framework for improved groundwater management by local authorities, and becomes effective January 1, 2015. The legislation requires that local agencies sustainably manage groundwater basins over a long-term planning horizon, and allows for state intervention by the State Water Board when additional efforts are needed to protect groundwater resources. The SGMA defines sustainable groundwater management, provides local agencies with tools and authorities to manage basins, and sets a timeline for implementation. Local groundwater sustainability agencies (GSAs) must be formed by June 2017, and groundwater sustainability plans (GSPs) must be completed for basins with the greatest need by 2022. Basins that must adopt a GSP must achieve sustainability within 20 years of plan adoption. 4

Sections 3.1.1.2.2, 3.2.1.2.2, 3.3.1.2, and 3.8.1.2 of the Draft EIS/EIR should be updated to include a discussion of the SGMA, which will be implemented during the 10-year timeframe (2015-2024) of the proposed project. The SGMA will affect the proposed buyer and seller regions in regard to their groundwater management, land use, water demands, and water availability. The SGMA also requires that GSAs, address groundwater quality issues and possible effects on groundwater dependent ecosystems (GDEs) caused by groundwater extraction. The Draft EIS/EIR should also be updated to address the management programs and regulatory requirements established under the SGMA, specifically new groundwater data that will be made available as part of a GSP that could be integrated into the proposed monitoring and mitigation program. The Draft EIS/EIR should also be updated to require that any transfers follow requirements (monitoring, reporting, and if necessary limits on pumping) required by a GSA or GSP.

Comment #2: Data and Modeling Issues
The Draft EIS/EIR indicates that the Sacramento Valley is “flexible and can respond to changes in hydrologic conditions and Central Valley Project (CVP) allocations (Executive Summary section 1.2)” as opposed to the southern Central Valley where there is a dire need for water. This conclusion appears to be based on an analysis of existing data primarily consisting of Department of Water Resources (DWR) hydrographs, supply availability data provided from potential sellers, and modeling results from the SACFEM2013 model. The State Water Board has the following comments regarding this assessment.

1. The analysis should include recent data showing significant groundwater depletions in the Sacramento Valley. There are several data sets and reports available from DWR that should be included in the analysis of groundwater availability, but are not. DWR has published a drought report (DWR, April 30th, 2014) showing groundwater declines for significant portions of the Sacramento Valley. The Draft EIR/EIS should include an analysis of how additional water extractions could affect local groundwater levels given the current groundwater elevations and drought status. 5

Section 3.1.1.3, page 3.1-5, describing the existing conditions of water supplies available for transfer should be updated to include groundwater data (e.g., DWR's California Statewide Groundwater Elevation Monitoring (CASGEM), basin prioritization results, etc.) to support the stated assumptions of the quantity of groundwater available in seller areas for transfer through groundwater substitution. 5

2. The groundwater quality analysis should include additional assessments of groundwater quality, including the State Water Board's AB2222 report (Communities that Rely on Contaminated Groundwater Source for Drinking Water, available at: http://www.swrcb.ca.gov/water_issues/programs/gama/ab2222/index.shtml), GeoTracker data, and GeoTracker GAMA data to assure that potential impacts from mobilizing contaminant plumes and other groundwater quality impacts are adequately evaluated. 6

3. The statements in sections 3.2.2.4.1 page 3.2-28, and section 3.2.2.5.1, page 3.2-42, that "groundwater quality in the [seller service] area is generally good and sufficient for municipal, agricultural, domestic and industrial uses" is potentially overly broad. The conclusion does not account for current groundwater quality monitoring, including monitoring data from wells in the proposed seller areas that have been identified to be within close proximity of nitrate contamination.

   In order to accurately reflect the highly variable groundwater aquifer properties such as hydraulic conductivity and transmissivity, it is necessary to incorporate all well information within a data set. Most aquifers are neither homogeneous nor isotropic, and the hydraulic conductivity can be characterized differently in all directions. If the intent of the modeling analysis is to simulate the effects of the operation of high-productivity irrigation wells screened within the major producing zones, then it would be prudent to characterize these production zones with as much information as possible to avoid bias. In Section D.3.6, paragraph 3, the Draft EIS/EIR states that "all test data from wells that reported a well yield below 100 gallons per minute were eliminated from consideration, as were the test data from wells with a total depth less than 100 feet." Are the criteria for filtering the well test data mutually exclusive or inclusive? If a well had low yield data and was located 600 feet below the surface, then it should be included in the data set. This filtered data set contains one of the most important parameters in the model and can influence flow direction and velocities and should be characterized as accurately as possible. As a result of filtering the data, the results do not reflect heterogeneous/anisotropic conditions seen in the subsurface. These subtle differences in the subsurface are what comprise the hydrodynamic character of each aquifer and without this data, the conclusions drawn by the model are potentially unreliable. The Draft EIS/EIR should have a better description of model parameters and inputs, and the potential effects that inclusion/exclusion of certain types of data could have on model results. 7

4. The project model is based on an abbreviated calibration set from 1970 to 2003 that does not appear to represent current water use, precipitation, and drought conditions or future climate change scenarios, which are generally drier. Groundwater recharge in the northern part of the Central Valley is below normal due to drought conditions. 8

Consequently, it could take several years to recharge the volume of water exported during a single year of transfers. This project proposes to export as much as 512,000 acre-feet of water annually. With the current drought, basin yield for these projects could be well below the amount used for the project model. As such, the interpretations based on the model may underestimate impacts to the area.

Section 3.1.2, page 3.1-14, describing the assessment methods used to determine the environmental impacts associated with the project should be revisited. The water year time period (1970-2003) used for the model fails to account for current environmental conditions and water use trends. For example, the model assumes that water transfers occur in 12 out of the 33 year time period. However, the State Water Board's Division of Water Rights' Water Transfer Program records indicate that water transfers have occurred for the last six consecutive years of the current program's record (2009-2014). It is reasonable to expect that establishing a long-term transfer program would facilitate a higher frequency of water transfers, which would result in more frequent groundwater substitution transfers. 8

In addition, known conditions do not appear to match what is shown in the Draft EIS/EIR. There are many wells in the northern Sacramento Valley that have cones of depression that cover large areas and are not accounted for. DWR maps show groundwater depletions in excess of 20 feet for shallow, intermediate, and deep groundwater aquifers from spring 2004 to spring 2013. The set of wells used to calibrate the model do not include wells that have undergone considerable groundwater elevation losses in excess of 20 feet within the last 10 years. The DWR potentiometric and groundwater elevation maps were created using over 200 wells around the northern Sacramento Valley. Choosing well locations and values that are not located within the cone of depression areas are not reflective of current conditions and will sway model results and how the system responds to future groundwater extraction. 9

Comment #3: Monitoring and Mitigation

The Draft EIS/EIR references a Draft document titled Technical Information for Preparing Water Transfer Proposals and Addendum for providing guidance on the development of proposals for groundwater substitution water transfers; however, information on these documents were not described in detail. Based upon the information provided in the Draft EIS/EIR, there are several additions and clarifications that could strengthen the Mitigation and Monitoring Program (M&MP):

1. Groundwater elevation data captured by the sellers should be required to be submitted to DWR's CASGEM Program, and sellers should be required to submit their information to any GSA for development of the basin's GSP. Although the sellers may be able to address groundwater depletions within their own service areas, the groundwater extractions may influence areas far outside the boundaries of the seller agencies. The only way to assess basin-scale impacts of exporting hundreds of thousands of acre-feet of water is a comprehensive basin-scale monitoring program. Eventually, development of GSAs will produce basin-scale data repositories. However, those GSAs have not yet been developed. In the interim, CASGEM offers an existing method to compile and analyze the data. As an alternative, the sellers may submit the data to the State Water Board's GeoTracker GAMA system. Local water districts should also be involved in 10

monitoring and mitigation processes so they can provide oversight on the entire area, manage disputes, and activate any mitigation processes. 10

2. It is unclear why groundwater elevation monitoring reports should be submitted only to Reclamation. DWR, local agencies (e.g., GSAs, counties, local water districts, others), and the State Water Board all have regulatory mandates to protect and manage groundwater resources. At a minimum, the data provided through the monitoring reports should be made available to any public agency with local authority to manage groundwater. We suggest making the reports available on a publicly-accessible website or database. 11

3. To ensure that impacts to water quality and other users do not occur as a result of this project, the M&MP program should require: sellers to incorporate existing water quality data from CASGEM, the State Water Board's AB 2222 report, GeoTracker GAMA, and GeoTracker; should require an analysis of known potential contaminant sites; and should require setbacks from known contaminant sites or plumes. Where appropriate, the programs should include an analysis of well screen intervals, water source, and potential contaminants in the area. The State Water Boards' GeoTracker system shows the location of thousands of leaking underground storage tanks, including sites within the seller's service areas. Leaking tanks typically affect the shallowest portions of an aquifer. Table 3.3-3 shows that many of the proposed sellers' wells are located in relatively shallow portions of the aquifer. For example, The Natomas Central MWC estimates that wells pumping at 5,500 gallons per minute (gpm) are located at depths as shallow as 150 feet below the ground surface. A contaminant can quickly and easily migrate from the surface to a depth of 150, particularly where the local geology is hydrogeologically conducive for rapid infiltration. 12

4. The mitigation component is vague, and does not identify trigger points that activate a mitigation process. Nor does the mitigation plan identify who will require the mitigation, who will oversee the mitigation, and who will ensure that mitigation is completed. The document, in Section 3.3.4.1.3, describes a scenario where the seller would be responsible for self-initiating and managing the mitigation plan. Leaving the sellers to self-mitigate is a potential conflict of interest, and may result in scenarios where adverse impacts to groundwater and other resources go unaddressed. 13

The M&MP requirements proposed in the Draft EIS/EIR (section 3.3.4.1, page 3.3-88) do not consider all local regulations. Of the 28 proposed seller agencies, 7 agencies have existing Groundwater Management Plans (GWMPs), which include M&M requirements that may be duplicative. The SGMA will require that additional seller districts be part of a GSP (which will replace any existing GWMPs). As with GWMPs, the GSPs will contain local M&MP requirements. The Draft EIS/EIR M&MP should be rewritten to ensure that proposed seller agency activities meet the regulatory requirements in the existing GWMPs or future GSPs. 14

Comment #4: Groundwater/Surface Water Interactions and Groundwater Dependent Ecosystems
Section 3.1.2.4 makes assumptions regarding groundwater availability for groundwater substitution transfers in seller areas that may misrepresent existing groundwater conditions. While the Draft EIS/EIR acknowledges that groundwater/surface water interactions exist, and that groundwater can contribute an important percentage of stream baseflow, the document does not account for potential impacts to surface waters in the sellers' areas that are caused by significant groundwater depletion. As written, the Draft EIS/EIR implies that natural in-stream groundwater recharge has a direct impact on streamflows, but does not consider how groundwater depletion in the sellers' area might reduce surface water baseflow. Additionally, the Draft EIS/EIR assumes that current groundwater levels are being sustainably managed and that there is adequate groundwater available to ensure reliable water sources for the proposed groundwater substitution transfers. The Draft EIS/EIR makes this assumption without demonstrating that current conditions and ongoing practices are not impacting groundwater dependent ecosystems. 15

The Draft EIS/EIR includes a series of maps (figures 3.3-26 through 3.3-31) showing simulated change in groundwater head, for different depths, for the 1976 and 1990 transfer seasons. Those maps are illustrative, but do not represent current conditions. As noted above, transfers have taken place for the last six consecutive years. In combination with information that a single year's worth of drawdown could reduce shallow-aquifer levels by 15 to 20 feet (e.g., Figure 3.3-31, near the Cordua Irrigation District), there is significant concern that continued transfers will harm groundwater dependent ecosystems. Consecutive years of transfers could lower groundwater elevations to the point that ecosystems (including wetlands, springs, and streams) are disconnected from groundwater, causing harm to local species. 16

Section 3.8.2.1, page 3.8-31, describing the assessment methods used to determine transfer effects on groundwater dependent ecosystems leaves out critical information and appears to make incorrect assumptions in assessing harmful effects to groundwater-dependent ecosystems. (Section 3.8.2.1). The water year time period (pre-2003) used for the model, does not account for current environmental conditions and water use trends. Furthermore, the assumption that there will be no groundwater/surface water interaction where pre-transfer water levels are already more than 15 feet below ground surface is not supported. Baseflows may be disconnected to the stream course in one area of the catchment, but discharge to the land surface as streamflow or a spring in other areas of the basin. In addition, the logic appears to be circular, since pumping related to the proposed transfers can drive groundwater elevations to depths greater than 15 feet below ground surface. 17

Section 3.8.2.1 also discusses impacts to species that could occur where groundwater dependent ecosystems are cut off from their water source due to transfer-related pumping. The assumption that impacted species will be able to adjust to lowering groundwater levels in a single water year is not supported (Section 3.8.2.1.1, page 3.8-31). The 15-foot cutoff is based on a model run that uses decade-old data, and does not account for regional or basin specific geology that defines the extent of surface water-groundwater interactions. 18

The Draft EIS/EIR appears to disregard potential effects to groundwater dependent ecosystems that could occur in the sellers' area. A more thorough discussion of the effects of groundwater extraction on ecosystems in the sellers' area should be included in section 3.8.2.4, page 3.8-46. The associated impacts to the groundwater dependent ecosystems are determined to be not significant with the implementation of Mitigation Measure GW-1. However, the mitigation 19 appears to be inadequate (where the primary mitigation action is to reduce groundwater pumping). To prevent negative impacts to groundwater dependent ecosystems, the mitigation plan should require preventative actions rather than reactive approaches to ensure impacts do not occur. 19

Comment #5: Groundwater Levels in the Buyers' Area
In Section 3.3 (Table 3.3-7, page 3.3-86 and again on page 3.3-87), the Draft EIS/EIR states that transfers could increase groundwater levels, eliminate or minimize land subsidence, and improve groundwater quality in the Buyer Service Area by reducing groundwater pumping during shortages. This statement is potentially misleading. In order to show that the transfers would increase groundwater levels (presumably through percolation of excess irrigation water, and/or conjunctive recharge), the Draft EIS/EIR should include a water balance for the buyer's areas. In all likelihood, the volume of the transfer would need to be significantly greater than the amounts proposed for long-term transfer in order to replace the amount of groundwater that is currently extracted to meet agricultural demands in the buyer's region. For example, the Draft EIS/EIR states that the average annual groundwater production in the San Joaquin basin is 0.9 million acre feet (Section 3.3, page 3.3-41), which is more than the sum of the proposed transfers. It is not plausible to assume that transfer water will solve the San Joaquin groundwater depletion issues, especially considering precipitation and mountain-front recharge amounts have decreased in response to the drought. While the transfers may slow the rate of groundwater decline in the buyer's area, there is no basis to state that the application of the transfer water alone will raise groundwater levels. Similarly, while the transfers may temporarily slow subsidence, unless the transfer water raises groundwater elevations above historic lows the additional water is unlikely to halt subsidence (although it may slow locally significant rates). It would be more productive to show a simple water balance for the respective buyer's areas, with a discussion of how much groundwater pumping, in addition to transfer water, is needed to sustain current and projected agricultural practices. 20

Please contact Erik Ekdahl at (916) 341-5316 or erik.ekdahl@waterboards.ca.gov, if you have any questions or would like to discuss this matter further.

Sincerely,

ORIGINAL SIGNED BY

Diane Riddle, Manager
Hearings & Special Program Section
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LA01

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Re: Long-Term Water Transfers Program Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR)

Dear Mr. Hubbard and Ms. Mizuno:

Butte County appreciates the opportunity to provide comments on the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the proposed Long-Term Water Transfers Program. Butte County and its surrounding region have a vested interest in assuring that the Long-Term Water Transfers Program has the least impact upon the community, agricultural economy and environment. Our region's water resources provide the life blood for our agricultural-based communities, economy and environment. Much of our local water supply comes from the various groundwater basins throughout the region that are recharged through these creeks and rivers. 1

We are troubled by the short amount of time afforded to provide comments on the EIS/EIR. It has been almost four years since the Bureau released the draft EIS/EIR scoping document. The Butte County Board of Supervisors submitted comments on the scoping document on February 22, 2011. Three years later the Bureau released a draft EIS/EIR, yet only provided the public 60 days to review, analyze and comment. The community has a strong interest in the Long-Term Water Transfers Program. So, in fairness, the Bureau of Reclamation (Bureau) should extend the comment period for at least ninety days.

Based on our preliminary review, we believe that the EIS/EIR is seriously flawed and will need to be revised and recirculated. The relied upon data is outdated, incomplete and selectively chosen. The result is that the EIS/EIR fails to meet the requirements of the National 2

Environmental Policy Act and the California Environmental Quality Act. Again, due to the 2 inadequate amount of time afforded to comment, the comments provided by the Butte County Board of Supervisors do not reflect a full review of the document.

The Long-Term Water Transfers Program purports to assist water users south of the Delta with immediate implementable and flexible supplemental water supplies to alleviate shortages. The project objectives claim that shortages are expected due to hydrologic conditions, climatic variability, and regulatory requirements. Project justification intends to address unforeseen, short-term water supply challenges. The reality is that the circumstances facing the water users 3 south of the Delta are neither short-term nor unforeseen. These water supply reliability challenges are baseline conditions that must be addressed at the local and regional level. Ironically, water users north of the Delta face similar challenges in terms of hydrologic conditions and climatic variability, but the EIS/EIR inadequately assesses these limitations. The project intends to establish a long-term water transfer program to meet the current and future demands south of the Delta, not based on any viable criteria.

Even though the EIS/EIR identified significant impacts in the Sacramento Valley, the methodology underestimated those impacts. The EIS/EIR identified significant impacts including lower groundwater elevations, changes to groundwater quality, reduction in groundwater recharge and decrease flows in surface water. However, it fails to take into account that the reduction in stream flows and the lowering of Lake Oroville that will harm the local 4 economy. In addition to underestimating these impacts, the mitigation measures in the EIS/EIR are not viable and will not mitigate the significant impacts. The following specific examples highlight the flaws in the EIS/EIR and provides justification for a revised and recirculated EIS/EIR.

First, the description of the regulatory setting in Chapter 3 – Groundwater (section 3.3.1.2) is incomplete, misleading and inaccurate. The document makes no mention of the recently enacted Sustainable Groundwater Management Act. The implementation of the Sustainable Groundwater Management Act will occur during the ten year period of the water transfer program. The Sustainable Groundwater Management Act will affect the buyer and seller regions in regard to their groundwater management, land use, and water demands. The data and management programs developed through the Sustainable Groundwater Management Act will change the assumptions in the EIS/EIR.

Second, the EIS/EIR must reference and acknowledge Area of Origin provisions in the Water 5 Code. Specifically, the EIS/EIR must reference Water Code 85031, which states, "*This division does not diminish, impair, or otherwise affect in any manner whatsoever any area of origin, watershed of origin, county of origin, or any other water rights protections, including, but not limited to, rights to water appropriated prior to December 19, 1914, provided under the law. This division does not limit or otherwise affect the application of Article 1.7 (commencing with Section 1215) of Chapter 1 of Part 2 of Division 2, Sections 10505, 10505.5, 11128, 11460, 11461, 11462, and 11463, and Sections 12200 to 12220, inclusive.*" Honoring area of origin water rights is consistent with state water policy and a foundational element to California's water future. In addition, the EIS/EIR should also discuss how the project complies with SB1X, which calls for a reduced reliance on the Delta and to promote regional water supply reliability.

The description of the local regulatory setting in the EIS/EIR failed to reference the Butte County Groundwater Conservation Ordinance (Chapter 33 of the Butte County Code), which Butte County voters overwhelmingly adopted in 1996. The Groundwater Conservation Ordinance requires a permit for water transfers that include a groundwater substitution component. The primary purpose of this Ordinance is to ensure that an adequate independent environmental review occur and to assure that groundwater resources would not be adversely 5
affected (i.e., overdraft, subsidence, saltwater intrusion) or result in uncompensated injury to overlying groundwater users and others. Additionally, the process of the Groundwater Conservation Ordinance brings a measure of transparency and public involvement that should be part of any water governance process. It is imperative that the proposed program adhere to the spirit and intent of local groundwater ordinances that have been codified since the Drought Water Bank held in the early 1990s. In this regard, the program needs to recognize that groundwater basins can extend across multiple administrative jurisdictions. Groundwater substitution transfers that occur in Colusa or Glenn counties have the potential, over the long term, to draw down groundwater sources shared with Butte County.

The EIS/EIR (Chapter 3, p. 21) includes a limited description of groundwater production, levels and storage in the Sacramento Valley. The section fails to report on the extensive data and analysis of groundwater conditions in this area. The EIS/EIR bases its analysis on a few selected wells, and provides a generalized description of regional groundwater conditions based on those wells. What is most troubling is the conclusion that the Sacramento Valley groundwater trends indicate that "wells in the basin have remained steady, declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods." This conclusion misrepresents the reality of groundwater conditions in the Sacramento Valley. The EIS/EIR acknowledges that one of the selected wells, 21N03W33A004M, shows a steady decline but discounts this data as an anomaly. The EIS/EIR fails to adequately take into consideration that current groundwater conditions are being impacted beyond routine seasonal fluctuations and does not account for projected impacts from climate change. In some areas, BMO alert or trigger levels 6
have been reached. There are a number of areas that have a steady decline in groundwater elevation unrelated to drought conditions. The EIS/EIR should have included a more comprehensive analyses of groundwater conditions and locally adopted Basin Management Objectives (BMO), clearly describing how BMOs will be utilized and how the program will address current conditions.

In addition to misrepresenting groundwater elevation data, the EIS/EIR also willfully ignored and misrepresented the current condition of streams and creeks in the Sacramento Valley. The Sacramento Valley subsidence monitoring data are readily available through the Department of Water Resources and the EIS/EIR should have included that data. For specific data and analysis of Butte County groundwater conditions, we invite the Bureau to review the annual Groundwater Status Report at:
http://www.buttecounty.net/waterresourceconservation/GroundwaterStatusReports.aspx.

We have concerns over the modeling methodology and the resultant appraisal of that data. Unfortunately, the limited amount of time afforded to comment precludes Butte County from conducting an in-depth analysis. However, a preliminary review of the modeling data raised a 7
number of questions. One is the implication of the limited dataset to conduct the CalSim II

modeling analyses. The choice of data used to establish baseline conditions for the SACFEM2013 analysis is critical to identifying the impacts of the study. The reliance on data from 1970 to 2003 fails to take into account current conditions and trends. For example, the analysis of the data used lead to an assumption that 12 out of 33 years would result in groundwater substitution transfer events. However, recent experience (2000-2014) has shown 7
that transfer programs have actually occurred in 9 of 15 years; more than one and a half times that of the analysis. A reasonable expectation is that having an established Long-Term Transfer Program would facilitate a higher frequency of water transfers and that, in turn, groundwater substitution transfers would occur in most years. The discrepancy between calculated expectations versus actual occurrences demonstrates an obvious fundamental flaw in the EIS/EIR that requires revision.

One of the most egregious flaws with the EIS/EIR is how the impacts from groundwater substitution transfer programs are identified and mitigated. According to the EIS/EIR (p. 3.3-61), "an impact would be potentially significant if implementation of groundwater substitution transfers or cropland idling would result in:

- A net reduction in groundwater levels that would result in adverse environmental effects or effects to non-transferring parties;
- Permanent land subsidence caused by significant groundwater level decline.
- Degradation in groundwater quality such that it would exceed regulatory standards or would substantially impair reasonably anticipated beneficial uses of groundwater;"

Based on our preliminary analysis, the EIS/EIR fails to adequately assess the impacts from groundwater substitution transfer programs. The EIS/EIR underestimates the effects and fails to adequately mitigate those effects in regards to determining whether there is a net reduction in 8
groundwater levels that would result in adverse environmental effects or effects to non-transferring parties. As previously shown, the assumption that groundwater substitution would occur on a limited basis was false, so the simulated changes in water table elevations can only be assumed to be grossly underestimated. Additionally, the EIS/EIR conclusion that most wells in the Sacramento Valley are deeper than the resulting groundwater elevations is not true. In actuality, most of domestic wells are less than 100 feet. The combination of these two erroneous conclusions resulted in the EIS/EIR completely failing to assess the potential impacts of the groundwater substitutions to shallow domestic wells. The lowering of groundwater elevations from groundwater substitutions during a drought period would likely make a number of domestic wells inoperable. The conclusion that shallow wells would only see a reduction in yield and not go "dry" is equally untrue. During the past two drought periods, Butte County and the Sacramento Valley have responded to numerous incidents of domestic wells failing. The EIS/EIR must recognize and analyze how the Long-Term Transfer Program will contribute and exacerbate the impacts of a natural disaster to those who rely on domestic wells.

The EIS/EIR (Chapter 3.7) identified that the Long-Term Water Transfers Program will impact local streams and jeopardize critical ecosystems. Of particular concern is the calculated stream flow reduction in Little Chico Creek of more than 1 cubic foot per second and a reduction of 9
more than 10%. The EIS/EIR categorized the impact to Little Chico Creek as a significant impact. Unfortunately, the EIS/EIR underestimated the impacts and relied on outdated

information again. As mentioned previously, the EIS/EIR underestimates the frequency of
groundwater substitution events, and the data relied upon for analyses are outdated. The stream
gaging data along Little Chico Creek was based on data from 1976 to 1995, and the CalSimII
modelling results did not include data after 2003. Because the stream data relied upon in the 9
EIS/EIR do not reflect current baseline conditions in the Sacramento Valley, it raises significant
doubts to the validity of the conclusion that the resultant reduction in flows, particularly in Little
Chico Creek, would not impact spring-run Chinook salmon. Therefore, the Bureau must
reevaluate the environmental impacts to streams and aquatic ecosystems based on current data.

The environmental analysis identified a number of significant impacts requiring mitigation.
Unfortunately, the proposed mitigation measures, particularly Mitigation Measure GW-1:
Monitoring Program and Mitigation Plans, will not mitigate adverse environmental effects or
minimize potential effects to other legal water users. The EIS/EIR, as written, does not include
criteria or standards that must be met to mitigate significant impacts and the Monitoring Program
(3.3.4.1.2) has vague and subjective standards for what constitutes as an acceptable monitoring
network. The EIS/EIR should assess the existing monitoring network and identify monitoring
gaps based on the locations of potential willing sellers.

10

Another fundamental flaw is the expectation that potential sellers be required to develop a
mitigation plan. The initial premise of the mitigation plan is that the seller's monitoring program
would indicate whether the operation of wells for groundwater substitution pumping are causing
substantial adverse impacts. Unfortunately, because the definition of substantial adverse impacts
is not defined, the process to monitor and mitigate third party impacts lacks clarity. First, the
Long-Term Water Transfers Program must define the specific parameters for what constitutes
substantial adverse impacts. Then the Long Term Water Transfers Program must have an
unambiguous, transparent, locally vetted dispute resolution program. It is imperative that the
Long-Term Water Transfers Program recognize that potential impacts associated with the
transfer of water from the Sacramento Valley need to be addressed through this type of approach.

The description of potentially significant unavoidable impacts (Section 3.3.5) contains inaccurate
statements and misleading information. First, it is unclear why the Northern Sacramento Valley
Integrated Regional Water Management Plan (NSVIRWMP) is included in this section. It
appears that the Bureau does not understand the policy and governance of the NSVIRWMP.
The NSVIRWMP does not have programs or project priorities that could be construed as
potentially causing significant unavoidable impacts.   Similarly, the reference to and
characterization of the Tuscan Aquifer Investigation Project is inaccurate. The Tuscan Aquifer 11
Investigation Project was a scientific project that intended to improve the understanding of the
recharge characteristics of the lower Tuscan Formation and the interconnectedness of the basin.
The characterization that the Tuscan Aquifer Investigation Project "would increase pumping
within (or near) the Seller Service Area" is categorically false.   If the Bureau had taken the time
to review the data and reports from the Tuscan Aquifer Investigation, they might have improved
their analysis by using current scientific data. It is apparent that they chose not to do so and
mischaracterized a scientific investigation. We demand that the Bureau remove the reference to
the Tuscan Aquifer Investigation Project.

Finally, we have questions and concerns regarding the designated lead agencies in the EIS/EIR. The Department of Water Resources (DWR) should be designated as a lead agency rather than as a Responsible Agency. A number of the participating agencies are State Water Project (SWP) Contractors regulated by DWR and the conveyance for the project will use SWP facilities under the jurisdiction of DWR. One of the risks and uncertainties identified in Chapter 2 of the EIS/EIR was the ability to coordinate water transfers with DWR. Additionally, we fail to understand why the San Luis & Delta-Mendota Water Authority (SLDMWA) is the only lead water agency. Other water agencies have responsibilities equal to those of SLDMWA. The roles and responsibilities of participating agencies (Section 1.5) is inadequate and vague. The EIS/EIR fails to justify the choice of the SLDMWA as the sole lead agency when there is such a clear conflict of interest between the SLDMWA and the northern Sacramento Valley counties that overlie the groundwater sources that will contribute to groundwater substitution transfers. The document fails to provide a rationale for not including other water agencies named in the EIS/EIR as lead agencies. 12

The magnitude of the proposed program is daunting and raises considerable concerns. In our comments on the scoping of the EIS/EIR in 2011, we surmised that an adequate EIS/EIR may not be possible based on the length and breadth of the proposed program. It appears that our concerns are true. 13

In conclusion, we cannot stress enough that actions through the Long-Term Transfer Program could have grave economic and environmental consequences in the Sacramento Valley that must be addressed. The EIS/EIR woefully fails to meet minimal environmental assessment standards, provides misleading statements and avoids including a complete, current, data set. We recommend that the Bureau of Reclamation extend the comment period for at least 90 days to allow a more complete review. Upon receipt of the comments, the Bureau must remedy the deficiencies in the EIS/EIR and recirculate it for comment. 14

Thank you for your consideration.

Sincerely,

Doug Teeter, Chair
Butte County Board of Supervisors

LA02

CITY OF CHICO
INC 1872

COMMUNITY DEVELOPMENT DEPARTMENT

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December 1, 2014

Brad Hubbard
Bureau of Reclamation
2800 Cottage Way, MP-410
Sacramento, CA 95825
Sent via Email to bhubbard@usbr.gov

Frances Mizuno
San Luis & Delta-Mendota Water Authority
842 6th Street
Los Banos, CA 93635
Sent via Email to frances.mizuno@sldmwa.org

Re: Comments on the Long-Term Water Transfers Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) – Public Draft

Dear Mr. Hubbard and Ms. Mizuno:

This letter is to provide the City of Chico's comments regarding the adequacy of the EIS/EIR analysis of the environmental effects, and mitigation for, water transfers from water agencies in northern California to water agencies south of the Sacramento-San Joaquin Delta and in the San Francisco Bay Area.

Through its General Plan, it is Chico's policy to oppose regional sales and transfers of local groundwater, including water export contracts, and the EIS/EIR should acknowledge and clearly highlight such inconsistency with a General Plan (CEQA Guidelines § 15125(d)). The Tuscan aquifer is the primary groundwater basin underlying and providing municipal and agricultural water to Chico and its Planning Area. It's for this reason that the City opposes transfers of local groundwater in the long-term interest of a safe and reliable municipal water supply, and to support the regional economy and the environment. 1

Beyond our opposition to the transfer project as a matter of policy, our specific concerns regarding the EIS/EIR include:

- While 60 days is the legal minimum for public review and comment on a Draft EIS/EIR, it is not an appropriate review time for such an important and voluminous document that attempts to analyze and mitigate the potential impacts of a six county, 10-year water transfer program. We request that the comment period be extended for at least an additional 90 days. 2

- The Federal Register notice for the EIS/EIR states that "[t]ransfers of CVP supplies and transfers that require use of CVP or SWP facilities are subject to review by Reclamation and/or *DWR* in accordance with the Central Valley Project Improvement Act of 1992, Reclamation's water transfer guidelines, and California State law. Pursuant to Federal and State law and subject to separate written agreement, Reclamation and *DWR* would facilitate water transfers involving CVP contract water supplies and CVP and SWP facilities" (emphasis added). CEQA Guidelines Section 15367 and Section 15051 suggest that given the prominent role that DWR plays in the proposed water transfers, it is not proper that SLDMWA is the Lead Agency for the purposes of CEQA. A number of the participating water agencies are State Water Project contractors 3 regulated by DWR and the conveyance for the project will use SWP facilities under the 3 jurisdiction of DWR.

- The project objectives for the EIS/EIR suggest that water shortages are expected due to hydrological conditions, climatic variability, and regulatory requirements. The project's justification therefore is to address unforeseen, short-term water supply challenges. The reality, however, is that the water supply challenges facing the water users south of the Delta are not 4 unforeseen or short-term --- they are simply a created existing condition. The project objectives for the EIS/EIR need to be revised to accurately reflect the project's true purpose --- establishing a long-term water transfer program to address a created and growing water supply reliability challenge south of the Delta.

- The EIS/EIR (Chapter 3) provides an incomplete description of groundwater production, levels, and storage in the Sacramento Valley. In particular, the chapter fails to report on the extensive data and analysis of groundwater conditions in Butte County. The EIS/EIR bases its analysis on a few selected wells, and provides a generalized description of regional groundwater conditions based on those wells. The EIS/EIR fails to acknowledge data available from Butte County's Department of Water and Resource Conservation showing that current groundwater conditions 5 are being impacted beyond routine seasonal fluctuations. In Butte County, Groundwater Basin Management Objective (BMO) alert levels have been reached for a number of wells, which requires specific management responses. The EIS/EIR should use recent and available well data to develop a comprehensive baseline condition for groundwater levels, and use locally adopted BMOs to determine appropriate thresholds of significance and mitigating responses for dropping groundwater levels.

- The EIS/EIR fails to consider the potential impacts of lowered groundwater levels on the City's urban forest. We request that the document be amended to include such discussion and analysis. The EIS/EIR acknowledges that groundwater levels would drop in response to groundwater pumping necessary to replace surface water transferred south of the Delta. The EIS/EIR does not provide any discussion or analysis of the relationship between the health of the City's urban 6 forest and dropping groundwater levels. The environmental and economic benefits of a healthy urban forest are well known, and include habitat for migrating birds and other wildlife; protection from the extreme impacts of climate change; filtering for rainwater and groundwater; carbon storage, which reduces the amount of harmful greenhouse gases; energy savings from its shade canopy; aesthetic benefits; and enhancement of property values.

- The environmental analysis does not adequately account for projected impacts associated with climate change. Reduced snow pack and sustained droughts are identified as key outcomes of climate change in California. Add to this the significant uncertainty regarding stream/aquifer 7 interaction and the multiple dry years experienced by the State. What affect will this have on sensitive aquifer systems in light of the impacts of climate change?

- The EIS/EIR identifies a number of significant impacts requiring mitigation. Many of the significant impacts rely on *Mitigation Measure GW-1: Monitoring Program and Mitigation Plans* for mitigation. The EIS/EIR directs that monitoring programs and mitigation plans spelled out by this measure be developed consistent with the *2013 Draft Technical Information for* 8 *Preparing Water Transfers Proposals* and the *2014 Addendum* documents prepared by the Bureau of Reclamation and Department of Water Resources. While the EIS/EIR purports that the monitoring and mitigation plans required by this measure will mitigate groundwater and biological impacts, the protocols, methodology, and emphasis outlined in the measure focus primarily on reducing effects to third party groundwater users. This critical mitigation measure needs to show a clear nexus for how it will reduce environmental impacts to groundwater and biological resources that will be caused by dropping groundwater levels. 8

Our greatest concern is that water agencies south of the Delta continue to rely upon a transfer-dependent water source that in turn depends on the use of north state groundwater. This proposed long-term water transfer program poses risks which we believe have not been addressed, and would be a precedent for future projects and decisions that could very seriously damage our city's – and our region's – environment, economy, and communities. 9

Thank you for your consideration of these concerns. If you have any questions, please feel free to contact me at (530) 879-6806.

Sincerely,

Brendan Vieg

Brendan Vieg, Principal Planner

cc: file

LA03

Colusa Drain Mutual Water Company

520 Market Street, Suite 3, Colusa, CA 95932
Phone 530-458-4849

December 1, 2014

Brad Hubbard
Bureau of Reclamation
2800 Cottage Way
Sacramento CA 95825
Email bhubbard@usbr.gov

RE: Long Term Transfers Draft Environmental Impact Statement/Environmental Impact Report

Dear Brad,

The Colusa Drain Mutual Water Company(Company) objects to the EIS/EIR in its current form and requests that the Bureau extend the comment period for at least 120 days to allow the Bureau, the Company, and the Company's shareholders additional time to consider more carefully the potential negative impacts of the proposed water transfers. 1

Colusa Drain Mutual Water Company includes 50,000 acres of prime farmland and habitat. Shareholder lands lie both sides of the 2047 drain canal west of the Sacramento River and east of Interstate 5. Its northern border reaches into the southern part of Glenn County, it spans from the north to south borders of Colusa County, and its southern boundary lies well into Yolo County in the Yolo Bypass south of Interstate 80. Shareholder lands lie immediately adjacent to, or proximate to, 7 of the potential sellers identified in the EIS/EIR. Most of the Company's shareholders rely on water from the 2047 drain canal as a primary source of irrigation water and many of the Company's shareholders rely on groundwater as a secondary source of irrigation water.

Our shareholders are particularly concerned that the EIS/EIR has not fully considered the negative impact of the proposed alternatives; Crop Idling, Crop Shifting, and Conservation, on surface flows in the 2047 drain canal. Maintaining a minimum flow of good quality water throughout the length of the 2047 canal during the irrigation season is essential to our shareholder's farm operations and each of these proposed transfer methods once implemented will most certainly have an immediate negative affect on both water flow and water quality in the 2047. The Company believes that the EIS/EIR does not fully account these negative affects nor does it provide sufficient mitigation alternatives. Since the 2047 drain was first constructed in the early 1900's, it has served the dual purpose of providing needed drainage for those upstream while providing summer flows for irrigation for those downstream. While difficult at times, this balance between drainage and irrigation has been largely successful for all parties. The company believes the practice of crop idling, crop shifting, and conservation, will result in reduced 2 surface flows in the 2047 and will increase salinity of the reduced remaining flow. If transfers are to be 2 made, a plan to sufficiently mitigate this negative impact must be proposed. We see no such plan in the EIS/EIR.

The Company is also concerned that, while the EIS/EIR appropriately recognizes that the proposed alternative, groundwater substitution, will have 'significant' negative impact on our shareholders groundwater supplies during such transfers, it incorrectly concludes that this impact will be 'less than significant' after mitigation. It is the Company's position that the EIS/EIR provides insufficient mitigation measures in the case of groundwater substitution. And further, that the EIS/EIR does not sufficiently address the damage done to shareholders and our entire community due to long term overdraft of underlying aquifers. In either case, whether in the context of mitigating negative impacts of current groundwater substitution transfers or mitigating negative impacts of long term overdraft of underlying aquifers, the EIS/EIR is inadequate. While groundwater transfers contemplated in the EIS/EIR have not yet taken place, several of the potential sellers identified in the EIS/EIR have already moved ahead with groundwater substitution transfers within Northern California, particularly, to the west side of Colusa, Glenn, and Yolo Counties via the Tehama Canal system. Our Company's shareholders are currently suffering the negative impacts of these groundwater substitution transfers through increased costs of pumping as a result of a lowered aquifers, and in some cases the loss of 3 irrigation water completely, where wells proximate to groundwater substitution wells go dry. Neither the groundwater substitution transfers taking place currently, within Northern California, nor the transfers contemplated by the EIS/EIR, provide a specific plan to limit the taking of groundwater by potential sellers. At a minimum, some responsible limit on the taking of groundwater must be established before surface water can be transferred on the basis of groundwater substitution. To date, no such limits have been set. Our local communities, motivated by heightened awareness as a result of ongoing drought conditions, and as a result of recent state legislation, have begun the process of establishing a system for the responsible management of our community's groundwater. Some communities, like Glenn County, have already made significant progress in this process, while others, Colusa County, for example, have only just begun the process. In no case, however, have sufficient procedures or protections been put in place to adequately provide for responsible execution or reasonable mitigation of groundwater substitution transfers. The Company believes that the alternative 'groundwater substitution' should be dropped entirely from the EIS/EIR as a viable alternative until such time as local communities impacted have completed their own studies and evaluations, developed reasonable plans that include reasonable limits for the taking of groundwater, and these studies, plans, and proposed limits then reconciled with conclusions already reached by the EIS/EIR.

The Long Term Transfers contemplated by the EIS/EIR if approved, will be of historic nature. Taken collectively, these transfers would be one of the largest single transfers of water from North to South. So the necessity to fully account the impact on all stakeholders, consider all stakeholders concerns, and 4 thoroughly respond to those concerns cannot be overstated. The Bureau, potential sellers, and potential buyers, have collaborated over several years to develop the EIS/EIR. Now they must carefully and patiently listen to those that their plan will affect. They must be prepared to explain how the proposed mitigation measures are sufficient to protect the Company's shareholders, and the community in general, from suffering the negative impacts of their plan. Today we are asking you to extend the comment period for at least 120 days to more reasonably allow for this process to take place. We would welcome an opportunity to listen and discuss in more detail the Bureaus plans. I can be reached directly at 530-218-1396(cellular). 4

Respectfully,

Jim Wallace

Jim Wallace
President, Colusa Drain Mutual Water Company

Cc: Frances Mizuno, Executive Director,
San Luis Delta-Mendota Water Authority

LA04

Harvey A. Bailey
Chairman of the Board

Nick Canata
Vice Chairman

Tom Runyon
Secretary/Treasurer

Ronald D. Jacobsma
General Manager

Jennifer T. Buckman
General Counsel

Member Agencies
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Delano-Earlimart I.D.
Exeter I.D.
City of Fresno
Fresno I.D.
Ivanhoe I.D.
Kaweah Delta W.C.D.
Kern-Tulare W.D.
Lindmore I.D.
Lindsay-Strathmore I.D.
Lower Tule River I.D.
Madera I.D.
Orange Cove I.D.
Pixley I.D.
Porterville I.D.
Saucelito I.D.
Shafter-Wasco I.D.
Stone Corral I.D.
Tea Pot Dome W.D.
Terra Bella I.D.
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December 1, 2014

VIA EMAIL TO: bhubbard@usbr.gov

Mr. Brad Hubbard
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Re: Draft Environmental Impact Statement/Environmental Impact Report for Long-Term Water Transfers, Central Valley and Bay Area, California

Dear Mr. Hubbard,

The Friant Water Authority (FWA) has reviewed the subject Draft EIS/EIR and has the following comments regarding the sufficiency and conclusions of the document. FWA is a joint powers authority whose members have contracts with Reclamation that entitle them to receive water from the San Joaquin River. A portion of the San Joaquin River water is subject to senior water rights reserved by the Exchange Contractors[1] and therefore is not available for delivery to the Friant Division until Reclamation has met its priority obligation[2] to provide substitute water supply to the Exchange Contractors.

1

The hydrologic conditions in the 2014 Water Year have highlighted the difficulties inherent in moving both CVP and transfer water through the Delta and the export facilities. In the 2014 Water Year, several districts that are identified in the subject DEIS/R as buyers and sellers executed one-year transfer agreements similar to those described and evaluated in the subject DEIS/R. Reclamation has yet to demonstrate how much transfer water has been moved from the sellers and whether or not the conveyance of that transfer

[1] The remainder of the San Joaquin River rights were purchased, condemned or otherwise acquired by Reclamation for the benefit of the Friant Division contractors. Water available under these rights must be provided to the Friant Division contractors, regardless of whether the terms of the exchange are being fulfilled or not.

[2] Reclamation has a "vested priority obligation" to provide substitute water to the Exchange Contractors, consistent with the terms of the Second Amended Exchange Contract. *Westlands Water Dist. v. United States*, 337 F.3d 1092, 1103-04 (9th Cir. 2003) ("*Westlands VII*").

water in any way impacted its operations and exports of CVP water needed to meet its priority obligation to the Exchange Contractors.

With this background in mind, we were disappointed to note that the DEIS/R for Long-Term Water Transfers did not address the fact that there is a great potential for the movement of transfer water to adversely affect delivery of CVP supplies south of the Delta. As noted in 1
Section 1.3.1.1, Reclamation acknowledges that it is inappropriate for a transfer to supplant or otherwise adversely affect the delivery of CVP supplies: "Transfer may not cause significant adverse effects on Reclamation's ability to deliver CVP water to its contractors." We assume that Reclamation is using the broad definition of the "CVP water" from the Central Valley Project Improvement Act; that definition includes the substitute supply for the Exchange Contractors as a type of "CVP water." Thus, Reclamation has acknowledged that the delivery of the transfer water may not cause "significant adverse effects" on Reclamation's ability to deliver the substitute supply of water to the Exchange Contractors, or any other CVP water.

The Project Description in Section 2.3.2.1 describes the criteria used to determine the amounts of water available for transfer under various transfer methods, but it does not describe how such determinations will be made available for public notice or review. Also, Section 2.3.2.3 describes the general operational approaches and actions associated with moving the water from the Seller through the Delta, but it does not describe how or when Reclamation will document 2
that the transferred water did not displace the delivery of substitute water to the Exchange Contractors. Without an adequate description of the procedures and methods to be used to document the development and movement of the transfer water, there is no substantial evidence to support the conclusion that conveying the transfer water has no detrimental effect on the delivery of substitute water to the Exchange Contractors.

Since the Project Description does not include features to ensure no adverse effects on Reclamation's ability to deliver substitute water to the Exchange Contractors, Chapter 3 should evaluate the potential for such impacts. Before the transfer program is approved, the DEIS/R should be revised to include, at a bare minimum, the following analyses and information:

- Whether the transferred quantity is real "wet" (as opposed to "paper") water;
- Whether the transfer displaces or otherwise diminishes the ability to deliver CVP water south of Delta;
- What methods will be used to measure the transfer water inputs to the river conveyance system (e.g., foregone diversions or releases from Yuba system), and where will those 3
measurements occur;
- What criteria and methods will be used to determine that transfer water made available by the selling district either made it to the pumps in the south Delta or was backed into storage (including which reservoir(s) the transferred water is being stored at and in what volumes);
- What criteria and methods will be used to determine that releases of transfer water from a CVP reservoir do not constitute water that would have otherwise have been released for in-stream uses; and

- What criteria and methods will be used to determine that water pumped at Jones or Banks pumping plants is in fact transfer water and not water that could have otherwise been pumped due to minimum CVP upstream releases or unregulated flows. 3

Unless this information and these analyses are included in the DEIS/R, it is not possible for the DEIS/R to baldly conclude that the transfer program does not have any potential adverse impacts on the delivery of CVP water supplies.

Thank you for the opportunity to comment on this DEIS/R. If you have any questions regarding these comments, please feel free to contact me at 916-804-0173 or via email to jbuckman@friantwater.org. Please continue to include me, as Friant's representative, on the list of interested parties for purposes of receiving any additional notices relating to the proposed long-term transfer program.

Sincerely,

Jennifer T. Buckman,
General Counsel

cc: Ronald D. Jacobsma, General Manager
Alex M. Peltzer, Esq.
Ernest A. Conant, Esq.
Kenneth J. Richardson, Esq.
Scott K. Kuney, Esq.
D. Zachary Smith, Esq.
John P. Kinsey, Esq.
Robert Saperstein, Esq.

LA05

Glenn-Colusa Irrigation District
Serving Our Lands and Environment Sustainably
Water Rights Established in 1883

October 14, 2014

Brad Hubbard
Bureau of Reclamation
2800 Cottage Way, MP-410
Sacramento, CA 95825

Subject: Draft EIS/EIR on Proposed Long-Term Water Transfer Program

Dear Brad,

The Glenn-Colusa Irrigation District (GCID) is providing this initial response letter to Reclamation on the Proposed Long-Term Water Transfer Program Draft EIS/EIR. The purpose of this letter is to inform Reclamation of GCID's intent to develop an independent Groundwater Supplemental Supply Program, as well as provide Reclamation with the District's position on the Long-Term Water Transfer Program. GCID wants to ensure that our local effort and Reclamation's project are not in conflict, and that the project selected to move forward for the Long-Term Program meets GCID's objective to ensure the long term sustainability of surface and groundwater resources in our region. GCID's position is that it will pursue, as a priority, the proposed Groundwater Supplemental Supply Program over any proposed transfer program within the region, including Reclamation's Long-Term Water Transfer Program (LTWTP). In addition, GCID's potential participation in Reclamation's LTWTP is ultimately subject to the consideration and approval of the GCID Board of Directors, and that has not occurred. 1

Following is a summary of GCID's proposed Groundwater Supplemental Supply Program, and some preliminary comments on LTWTP Draft EIS/EIR.

GCID Groundwater Supplemental Supply Program
GCID is proposing to install and operate five new groundwater production wells and operate an additional five existing groundwater wells to augment surface water diversions for use within GCID during dry and critically dry water years. The wells would have a production well capacity of approximately 2,500 gallons per minute, and would operate as needed during dry and critically dry water years for a cumulative total annual pumping volume not to exceed 28,500 acre-feet. Additional information is available at: http://gcid.net/GroundwaterProgram.php.

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The primary objective is to develop a reliable supplemental water source for GCID during dry and critically dry years. The proposed project goals are as follows:

- Increase system reliability and flexibility
- Offset reductions in Sacramento River diversions by GCID during drought years to replace supplies for crops and habitat
- Periodically reduce Sacramento River diversions to accommodate fishery and restoration flows
- Protect agricultural production

GCID's surface water supply reliability is becoming less certain as a result of the following:

- Litigation by environmental organizations challenging the renewal of the Sacramento River Settlement Contracts
- Increased delta flow requirements for delta smelt and delta outflows
- Increased flows and temperature requirements for fisheries

1

USBR Long-Term Water Transfer Program
GCID received the Draft EIS/EIR this week and has only initially begun its review. It is important for Reclamation to understand that GCID has not approved the operation of any District facilities attributed to the LTWTP Action/Project that is presented in the draft EIR/EIS. GCID will be conducting groundwater modeling for the Groundwater Supplemental Supply Program and will include an analysis of any potential cumulative impacts associated with GCID's Project and the LTWTP.

Based on our initial review of Reclamation's LTWTP Draft EIS/EIR, GCID has the following comments: 2

Figure 3.3-25. Simulated Groundwater Substitution Transfers
This figure demonstrates those years that a groundwater substitution program would likely occur and the associated quantities of groundwater substitution pumping. To meet the needs of GCID's Supplemental Supply Program, it is likely that pumping would occur simultaneously in many of these years. For example, 1992, 1994, and 1997 were critical water years in which GCID received a 75% water supply allocation and in those years the district would have pumped these wells for supplemental supply only. It is important to

underscore that GCID would prioritize pumping during dry and critically dry water years for use in the Groundwater Supplemental Supply Program, and thus wells used under that program would not otherwise be available for the USBR's LTWTP. 2

Table 3.3-3 Water Transfer through Groundwater Substitution
Table 3.3-3 lists 11 GCID wells with associated flow rates between 2,389-3,305 and well depths ranging from 500-1200 feet. GCID would need to thoroughly review this information in greater detail with Reclamation to make sure that well locations, proposed operational parameters, and well characteristics are accurate and which wells, if any, could be included in UBSR'S LTWTP. 3

Figures 3.3-26 thru 3.3-31
The figure does not accurately represent an assessment of cumulative groundwater effects on the groundwater system resulting from other groundwater wells in other districts. As previously mentioned, for the Groundwater Supplemental Supply Program GCID will perform groundwater modeling and will develop new water elevation maps in the vicinity of GCID's project. 4

As mentioned above, these comments are very preliminary as GCID conducts a more in-depth review of the EIR/EIS. If you would like to meet to discuss GCID's program or our initial comments, please contact me at 530-934-8881.

Sincerely,

Thaddeus L. Bettner
General Manager

Cc: Frances Mizuno, Executive Director,
San Luis Delta-Mendota Water Authority

LA06

Glenn-Colusa Irrigation District
Serving Our Lands and Environment Sustainably
Water Rights Established in 1883

November 18, 2014

Brad Hubbard
Bureau of Reclamation
2800 Cottage Way, MP-410
Sacramento, CA 95825

Subject: GCID Participation in Reclamation's Proposed Long-Term Water Transfer Program

Dear Brad,

As you know, Glenn-Colusa Irrigation District (GCID) sent you a letter on October 14, 2014, providing an initial response to Reclamation on the Proposed Long-Term Water Transfer Program Draft EIS/EIR. The purpose of the letter was to inform Reclamation of GCID's intent to develop an independent Groundwater Supplemental Supply Program, as well as provide to Reclamation the District's position on the Proposed Long-Term Water Transfer Program (LTWTP).

On November 6, 2014, GCID's Board of Directors took the following actions on the LTWTP:

Groundwater Substitution
The LTWTP identifies GCID as pumping 25,000 acre-feet in the years that transfers may occur. Importantly, while the LTWTP covers a ten-year period, transfers would occur only in the critical and/or dry years. Because GCID's surface water supply reliability is being challenged and GCID's surface supplies may be less reliable, GCID will need to implement its Groundwater Supplemental Supply Program in dry and critical years, primarily. Based on Figure 3.3-25 in the LTWTP Draft EIS/EIR, GCID would have pumped in 1992, 1994, and 1997, which were Shasta critical water years during which GCID received a 75% water supply allocation. 1

Based on the potential conflicts between the needs of GCID landowners and the LTWTP, the GCID Board decided that the District should proceed with its own Groundwater Supplemental Supply Program and should not participate in the Groundwater Substitution component in the LTWTP.

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Land Idling
The LTWTP identifies GCID as idling up to 20,000 acres (providing up to 66,000 acre-feet of transferrable water), which is based on the 20% land idling maximum. The Board evaluated what was in the best interest of GCID, its landowners, and the regional economy and environment. Based on those factors, the Board decided to decrease and limit its participation in the Land Idling component to no more than 10,000 acres (up to 33,000 acre-feet of transferrable water). 2

GCID requests that the LTWTP Draft EIS/EIR be revised to show these changes, and include a corresponding re-evaluation of the potential impacts that will be significantly reduced in Glenn and Colusa Counties as well as neighboring counties. 3

If you would like to meet to discuss GCID's program or our comments, please contact me at 530-934-8881.

Sincerely,

Thaddeus L. Bettner
General Manager

Cc: Frances Mizuno, Executive Director,
San Luis Delta-Mendota Water Authority

LA07

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December 1, 2014

<u>VIA U.S. MAIL AND E-MAIL</u>

Brad Hubbard
U.S. Bureau of Reclamation
2800 Cottage Way, MP-410
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bhubbard@usbr.gov

Re: Comments on the Long-Term Water Transfers Draft Environmental Impact Statement

Dear Mr. Hubbard:

Grassland Water District and Grassland Resource Conservation District ("GWD") submit the following comments on the Long-Term Water Transfers Draft Environmental Impact Statement/Environmental Impact Report ("EIS"). The EIS will cover individual and multi-year water transfers of up to 500,000 acre-feet per year from north-of-delta water users to south-of-delta water users, from 2015 through 2024 ("Project"). GWD is generally supportive of north-to-south water transfers, as long as potential adverse environmental impacts are avoided or mitigated. The following comments pertain to how the Project will affect Reclamation's operation of the Central Valley Project ("CVP") to meet refuge water supply requirements. Section 3406 of the Central Valley Project Improvement Act ("CVPIA") designates refuge water supplies as "mitigation" for "wildlife losses incurred" as a result of the construction, operation, and maintenance of the CVP. Accordingly, these comments have a direct relationship to the Project's impacts on 1 the environment, and each requires a written response under the National Environmental Policy Act.

1. Reclamation should be listed as a potential purchaser of water

First, Grassland Water District is a member agency of the San Luis & Delta Mendota Water Authority ("SLDMWA"), the CEQA lead agency for the Project. As described in the EIS, GWD and other south-of-delta refuges are within the service area of the SLDMWA.[1] GWD requests that the Bureau of Reclamation ("Reclamation"), on behalf of GWD and other south-of-delta refuges, be included in the list of potential purchasers of transferred water under the proposed Project.

GWD is informed that the failure to list refuges as potential Project water recipients may be an inadvertent omission. In the past, when refuges were inadvertently omitted from the list of potential recipients of transferred water, Reclamation has revised the applicable NEPA document.[2] The EIS should be revised to include the possibility that Reclamation may also purchase water from the listed sellers, on behalf of refuges. Making this change would not require any changes to the EIS analysis. Any impacts associated with the transfer of water from north of the delta to refuges south of the delta would be the same as those analyzed in the EIS, if not lessened by the environmental benefits that would accrue to the receiving refuges. 1

Reclamation has obligations under the CVPIA and section 3(a) of GWD's refuge contract to use its "best efforts" to acquire Incremental Level 4 water supplies. By including refuges in the EIS as potential beneficiaries of the Project's long-term north-to-south water transfer program, Reclamation could better facilitate water purchases for refuges, and would provide an incentive to north-of-delta landowners to offer water for sale to Reclamation's Refuge Water Supply Program. In fact, Reclamation has purchased refuge water supplies from at least one of the potential listed sellers in the EIS, the Anderson-Cottonwood Irrigation District. This year, Reclamation transferred a portion of that water to a south-of-delta refuge. It makes logical sense to include Reclamation as a potential purchaser of Project water, and to include refuges as potential recipients. To exclude this possibility from coverage under the EIS would be arbitrary and capricious, and would illustrate Reclamation's disregard for its duty to pursue the acquisition of Incremental Level 4 Water Supplies for refuges—an obligation that Reclamation persistently fails to meet.

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[1] EIS p. ES-4.

[2] *E.g.* Supplemental Environmental Assessment and Finding of No Significant Impact for the South of Delta Accelerated Water Transfer Program (2013), *available at*: http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=6999.

2. <u>Environmental commitments should benefit CVPIA refuges</u>

Second, Reclamation must consider the implementation of environmental commitments that provide direct benefits to CVPIA refuges, to help offset the impacts of the proposed Project on species such as migratory birds, the giant garter snake, and others. CVPIA refuges will become increasingly important sources of habitat for these species if large volumes of Project water are redirected from habitat-beneficial crops such as rice and corn to non-habitat-beneficial crops and to urban water users. With the likely decrease in available habitat that will result from the proposed Project, and other potential impacts identified in the EIS, CVPIA refuges will bear the brunt of responsibility for meeting the habitat needs that result from operation of the CVP. 2

Reclamation has proposed no environmental commitments, however, that would benefit CVPIA refuges. Reclamation should offer water sellers a choice between making additional mitigation and restoration payments to the CVPIA Restoration Fund, or directly selling a percentage of the proposed water to be transferred to the Refuge Water Supply Program. *If only 5 to 10 percent of the proposed water to be transferred were sold to the Refuge Water Supply Program, the persistent deficit in Level 4 refuge water deliveries would be significantly cured.*

3. <u>No adverse impacts on refuge water deliveries may occur</u>

Third, Reclamation must assure refuge contractors that the potential transfer of 500,000 acre-feet of water annually would have no adverse effect on the timing or volume of refuge water deliveries, or the future capability of the CVP to deliver full Level 4 refuge water supplies. CVPIA section 3405(a)(1)(H), and other provisions of Reclamation Law such as the Warren Act, prohibit Reclamation from approving water transfers if they would have any adverse effect on Reclamation's ability to deliver water to meet its contractual or fish and wildlife obligations "because of limitations in conveyance or pumping capacity." This prohibition must not be ignored. 3

The EIS does not describe the order of priority for use of CVP facilities, other than a statement that transferred water can only be conveyed "after Project needs are met."[3] GWD is increasingly concerned that Reclamation has prioritized the conveyance of water transfers over the delivery of water that refuges are contractually and legally entitled to receive. GWD suffered a 10% reduction in its contractual entitlement to receive firm Level 2 water supplies this year. Despite GWD's repeated requests for an explanation of this deficiency, GWD was instead left with the impression that full Level 2 deliveries this fall and winter may have been denied so as to avoid interference with proposed water transfers. This is

[3] EIS, p. 2-18.

unacceptable. Reclamation must provide a written response to this comment to confirm that all refuge water deliveries, including the full potential capacity for Level 4 water deliveries, will take priority over the conveyance of transferred water supplies. 3

4. Clarifications and assurances are needed for water transfers by Merced Irrigation District

The EIS contemplates that water may be transferred by Merced Irrigation District ("MID") through a variety of potential conveyance mechanisms. MID has a binding commitment, however, under its Federal Energy Regulatory Commission license, to provide 15,000 acre-feet of water directly to the Merced National Wildlife Refuge. Most of this water (13,500 acre-feet) is credited toward Reclamation's Level 2 water supply obligation to the Merced refuge, and the remainder is credited toward Reclamation's Incremental Level 4 obligation.[4] Reclamation cannot authorize transfers by MID to others unless and until MID's water delivery obligation to Merced National Wildlife Refuge is first met. To act otherwise would violate Reclamation's duties under the CVPIA and under Reclamation's water supply contract with the U.S. Fish and Wildlife Service. Reclamation should revise its EIS or provide a written response to this comment to confirm that water will not be authorized for transfer by MID in any year that MID fails to meet its obligation to provide 15,000 acre-feet of water to the Merced National Wildlife Refuge. 4

Moreover, the EIS describes a mechanism whereby MID would exchange water to others by delivering water to "refuges in the San Luis unit" that would in turn reduce their water use "from the Delta-Mendota Canal."[5] The EIS must note that under the terms of Reclamation's refuge water contracts, exchanges involving refuge water supplies must be agreed to by the refuge contractor. Furthermore, the proposed refuge exchange mechanism is not adequately described. There are only two refuges that can directly receive water from MID's conveyance system, Merced National Wildlife Refuge and the East Bear Creek Unit of the San Luis National Wildlife Refuge. These refuges are located east of the San Joaquin River, and they do not use water from the Delta-Mendota Canal. The EIS does not sufficiently explain how this proposed exchange mechanism would work.

Thank you for considering and responding to these comments, and please feel free to contact me to discuss any of these issues further.

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[4] *See* Exhibit "B" to Reclamation's contract with the United States Fish and Wildlife Service, *available at*: http://www.usbr.gov/mp/cvpia/3406d/env_docs/final/1758_exh_b_fws.pdf

[5] EIS, p. 2-25.

Sincerely,

Ricardo Ortega
General Manager

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December 1, 2014

SENT VIA EMAIL (bhubbard@usbr.gov)

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**RE: Comments on Long-Term Water Transfers EIS/R
State Clearinghouse No. 2011011010**

Dear Mr. Hubbard:

These comments on the Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report ("EIS/R") ("project") are submitted on behalf of the Local Agencies of the North Delta ("LAND"). LAND is a coalition comprised of reclamation and water districts in the northern geographic area of the Delta.[1] As local agencies in the Delta, LAND is concerned about any actions that would result in water supply and/or quality impacts in the Delta that may occur as a result of the project. This letter addresses the following inadequacies of the EIS/R: (1) use of the wrong lead agency under the California Environmental Quality Act (Pub. Resources Code, §§ 21000 et seq. ("CEQA")); (2) failure to consider the cumulative effects of the project in combination with the Bay Delta Conservation Plan ("BDCP"); and (3) inadequacy of mitigation for significant effects caused by implementation of the project. 1

San Luis & Delta-Mendota Water Authority is the Wrong Lead Agency

Under CEQA, the "lead agency" is "the public agency which has the principal responsibility for carrying out or approving a project . . . ." (Pub. Resources Code, § 21067.) Where several agencies have a role in approving, implementing or realizing a project, CEQA "plainly requires the public agency with principal responsibility to assume the role as lead agency." (*Planning & Conservation League v. Department of Water* 2

1 LAND member agencies cover an approximately 110,000 acre area of the Delta; current LAND participants include Reclamation Districts 3, 150, 307, 317, 349, 407, 501, 551, 554, 556, 744, 755, 813, 999, 1002, 2111, 2067 and the Brannan-Andrus Levee Maintenance District. Some of these agencies provide both water delivery and drainage services, while others only provide drainage services. These districts also assist in the maintenance of the levees that provide flood protection to homes and farms.

Resources (2000) 83 Cal.App.4th 892, 906.) According to the Third District Court of Appeal, "the lead agency plays a pivotal role in defining the scope of environmental review, lending its expertise in areas within its particular domain, and in ultimately recommending the most environmentally sound alternative." (*Id*. at 904.) "So significant is the role of the lead agency that CEQA proscribes delegation." (*Id*. at 907.)

According to the EIS/R, the San Luis & Delta-Mendota Water Authority ("SLDMWA"), "consisting of federal and exchange water service contractors in western San Joaquin Valley, San Benito, and Santa Clara counties, helps *negotiate* transfers in years when the member agencies could experience shortages." (EIS/R, p. 1-1, italics added.) Furthermore: "This EIS/EIR addresses water transfers to [Central Valley Project ("CVP")] contractors from CVP and non CVP sources of supply that must be conveyed through the Delta using both CVP, SWP, and local facilities. These transfers require approval from Reclamation and/or *the Department of Water Resources (DWR)*, which necessitates compliance with NEPA and CEQA." (EIS/R, p. ES-1, italics added.) 2

SLDMWA is not the proper CEQA lead agency for the project. Here, it appears that DWR has the principle responsibility with respect to carrying out and approving water transfers and would be the proper lead agency. Much like the lead agency role struck down in the *Planning and Conservation League* case, SLDMWA's assistance in negotiating transfers is insufficient to give rise to a lead agency role under CEQA. (See 83 Cal.App.4th at p. 906.) As a result of this error, the entire EIS/R process is tainted and must be restarted with the correct lead agency.

<u>BDCP as a Cumulative Project</u>

When conducting a cumulative impact analysis, a lead agency has the choice of using either the list-of-projects approach or the summary-of-projections approach, depending on which method is best suited to a particular situation. (CEQA Guidelines, § 15130, subd. (b)(1).) According to the EIS/R, "both methods" are used. (EIS/R, p. 4-3.) Yet the EIS/R fails to consider the effects of the project combined with the implementation of the BDCP. The BDCP is currently undergoing public review (Bureau of Reclamation is also the NEPA lead agency), and could be approved and implemented within the timeframe of the project. (See http://baydeltaconservationplan.com/PlanningProcess/EnvironmentalReview/TheProcess.aspx.) 3

The BDCP consists of new diversion facilities on the Sacramento River as well as other actions that constitute a proposed Habitat Conservation Plan within the Sacramento-San Joaquin Delta. While the diversion facilities would not be constructed within the 10 year timeframe of the project, other so-called conservation measures could be implemented. The cumulative effects of those aspects of the BDCP that could be implemented within the timeframe of the proposed project must be analyzed.

In particular, cumulative effects from reductions in Delta outflow should be analyzed. According to the EIS/R, the project would lead to changes in Delta hydrology. (EIS/R, p. 3.8-62.) These changes should be considered in conjunction with the BDCP, which may reduce Delta outflow by dramatically increasing the amount of open water habitat in the Delta (up to 65,000 acres tidal marsh). According to DWR data, open water and riparian vegetation consume about 67.5 acre-feet per year, which is much greater than most agricultural uses. (See Exhibit A.)[2] The project's potential, in combination with BDCP, to reduce Delta outflow must be considered. 3

The cumulative effects of weed growth that results from BDCP/habitat projects in the Delta and within the Seller service areas on fallowed lands should also be considered. The EIS/R apparently assumes that invasive weeds will be managed on fallowed lands in the Seller area. Invasive weeds, however, consume significant quantities of water and may result in less water being available for transfer than assumed in the EIS/R. According to a 2004 study, for instance, about "one million acre-feet of water is consumed by star thistle each year in the Central Valley above and beyond what would be consumed by annual grasses."[3] In addition to analyzing water demand of weeds in the Delta under BDCP as well as in the Seller service areas, effective weed management should be included as a mitigation measure.

Inadequacy of Mitigation Measures

The EIS/R contains inadequate mitigation for the significant effects of the project. In particular, Mitigation Measure GW-1 ("GW-1") does not meet basic CEQA requirements for mitigation. (*Cf.* CEQA Guidelines, § 15126.4; *Communities for a Better Environment v. City of Richmond* (2010) 184 Cal.App.4th 70, 94-95 (describing requirements for use of specific performance criteria to ensure the efficacy of the mitigation).) While the EIS/R states that this mitigation measure would reduce impacts related to natural communities in rivers and creeks in the Sacramento River Watershed, for instance (EIS/R, p. 3.8-51), this mitigation measure monitors wells, not river and creek levels. The analysis also assumes without any support that natural recharge will 4

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2 Department of Water Resources, Bulletin 168 (October 1978) titled, "Sacramento Valley Water Use Survey 1977," Table A-5 (showing 1976-77 Estimated Crop Evapotranspiration Values for the Delta Service Area).

3 Cal-IPC News, Newsletter of the California Invasive Plant Council (Summer 2014), p. 11, available at:
http://origin.library.constantcontact.com/download/get/file/1101215423203-171/Cal-IPC_News_Summer2014.pdf.

correct any environmental impacts that do occur. GW-1 also leaves entirely open the amount of time an adverse impact could occur and before it will be corrected. This approach fails to meet the requirement to mitigate the project's impacts to the extent feasible, as required by CEQA. (See Pub. Resources Code, § 21002.) While CEQA permits deferral of formulation of mitigation in certain instances, minimum requirements for deferred mitigation are not met by GW-1. 4

CONCLUSION

Overall, we remain concerned that the project, in combination with other cumulative projects, will significantly affect Delta water supply and quality for in-Delta users. While increased transfers have the potential to increase flows into the Delta, it is not clear that this project will result in such flow increases. Without actual increases in flows, this transfer program could facilitate increased diversions out of the Delta for CVP contractors, leaving in Delta water supplies further depleted and degraded. We respectfully request that the EIS/R be corrected and recirculated to correct the deficiencies identified in these and other comment letters prior to any action being taken on the project. Thank you for considering these comments. 5

Very truly yours,

SOLURI MESERVE
A Law Corporation

By: Osha R. Meserve

Osha R. Meserve

Enclosure: Exhibit A - DWR Bulletin 168 (October 1978), Table A-5

EXHIBIT A

TABLE A-5
1976-77 Estimated Crop Et Values
Delta Service Area
(in inches)

Land Use Category	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Total Oct.76-Sep.77	Oct.77	Total Nov.77-Oct.77
Sacramento-San Joaquin Delta															
Irrigated Pasture	3.2	1.5	1.0	0.7	1.5	3.6	5.4	4.8	6.9	7.7	6.4	4.7	47.4	3.4	47.6
Alfalfa	3.2	1.5	1.0	0.7	1.5	3.2	4.9	4.4	6.5	7.5	6.5	4.9	45.8	3.4	46.0
Deciduous Orchard (Fruits & Nuts)	2.6	1.5	1.0	0.7	1.5	2.7	3.8	4.0	6.1	7.4	6.1	4.3	41.7	2.6	41.7
Tomatoes	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.6	4.0	8.2	6.0	2.3	34.3	1.9	33.8
Sugar Beets	2.4	1.5	1.0	0.7	1.5	1.9	2.2	3.7	7.6	8.3	6.4	4.4	41.6	2.4	41.6
Grain Sorghum (Milo)	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.0	5.9	7.3	4.3	2.5	33.2	1.9	32.7
Field Corn	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.3	5.7	6.9	5.1	2.6	33.8	1.9	33.3
Dry Beans	2.4	1.5	1.0	0.7	1.5	1.9	2.2	1.7	5.7	6.2	2.7	2.5	30.0	1.9	29.5
Safflower	2.4	1.5	1.0	0.7	1.5	1.9	2.5	4.8	8.7	7.7	4.4	2.5	39.6	1.9	39.1
Asparagus	2.4	1.5	1.0	0.7	1.5	1.9	2,2	1.0	3.5	7.7	6.4	4.7	34.5	2.4	34.5
Potatoes	2.4	1.5	1.0	0.7	1.5	1.9	2.2	1.7	4.3	7.4	5.5	2.8	32.9	1.9	32.4
Irrigated Grain	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	1.0	1.0	1.6	26.1	1.6	24.7
Vineyard	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.8	5.3	6.5	5.3	3.4	34.5	2.4	34.5
Rice	3.2	1.5	1.0	0.7	1.5	1.9	2.8	5.6	8.8	9.8	8.1	5.5	50.4	3.4	50.6
Sudan	2.4	1.5	1.0	0.7	2.0	4.3	5.7	4.8	6.9	7.7	4.9	4.7	46.6	2.4	46.6
Misc. Truck	2.4	1.5	1.0	0.7	1.5	1.9	3.2	4.6	6.7	7.4	5.2	3.7	39.8	1.9	39.3
Misc. Field	2.4	1.5	1.0	0.7	1.5	1.9	2.2	2.4	6.1	7.4	5.0	1.9	34.0	1.9	33.5
Double Cropped with Grain															
Sugar Beets	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	4.2	5.2	5.8	37.7	3.4	38.7
Field Corn	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	4.3	6.3	6.1	39.2	2.7	39.5
Grain Sorghum (Milo)	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	1.8	2.7	6.1	5.2	36.5	1.9	36.0
Sudan	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	3.6	7.7	4.9	4.7	41.6	1.9	41.1
Dry Beans	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	3.1	7.6	3.5	1.5	36.4	1.9	35.9
Tomatoes	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	2.3	6.6	6.0	5.2	40.8	1.9	40.3
Lettuce	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	4.1	7.4	5.3	4.9	42.4	2.4	42.4
Misc. Truck	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	2.3	6.6	6.0	5.2	40.8	2.4	40.8
Misc. Field	2.4	1.5	1.0	0.7	2.0	4.3	5.7	3.1	4.1	7.4	5.3	4.9	42.4	3.4	43.4
Fallow Lands 1/	2.4	1.5	1.0	0.7	1.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	14.0	1.0	12.6
Native Vegetation 2/	2.4	1.5	1.0	0.7	1.4	3.7	3.8	2.1	2.3	2.6	2.3	2.0	25.8	1.6	25.0
Riparian Veg. & Water Surface	4.6	2.4	1.4	0.8	1.9	4.5	7.4	6.6	9.7	11.8	9.7	7.0	67.8	4.3	67.5
Urban	1.6	0.8	0.6	0.7	1.0	1.0	1.9	2.4	2.4	2.5	2.4	1.9	19.2	1.6	19.2

1/ Applies also to nonirrigated grain.
2/ Applies also to nonirrigated orchards and vineyards

Metric conversion: inches times 25.4 equals millimetres.

LA09

RECLAMATION DISTRICT

108

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December 1, 2014

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Re: Comments on Draft EIS/EIR on Proposed Long-Term Water Transfers

Dear Mr. Hubbard and Ms. Mizuno:

Reclamation District 108 ("RD 108") respectfully submits these comments on the September 2014 Draft Environmental Impact Report/Environmental Impact Statement ("EIS/EIR") for the above-referenced project.

RD 108 has no concerns with a reasonable groundwater substitution program. Indeed, RD 108 is identified as a potential transferor of groundwater substitution water in the EIS/EIR and may be willing to transfer up to 15,000 acre-feet per year of surface water made available through groundwater substitution. (Draft EIS/EIR, at Table 2-5.) 1

RD 108 is concerned, however, about the intensity and magnitude of the proposed Conaway Preservation Group ("Conaway") groundwater substitution program. RD 108 covers nearly 48,000 acres and will potentially substitute up to 15,000 acre-feet/year of groundwater to replace transferred surface water. RD 108 will thus pump less than 1/3 of an acre-foot per acre of land per year. On the other hand, Conaway owns 16,088 acres of land, but will pump up to 35,000 acre-feet/year under the proposed project. Thus, Conaway's proposed groundwater substitution program, as described in the EIS/EIR, will result in pumping of more than 2 acre-feet of groundwater per acre of land owned by Conaway.

Conaway, however, has an even more ambitious groundwater substitution program than the EIS/EIR indicates. Through an agreement with the Woodland-Davis Clean Water Agency ("WDCWA"), Conaway may pump up to an additional 10,000 acre-feet/year to substitute for a transfer of surface water rights to WDCWA. Accordingly, if Conaway pumps the maximum amount of groundwater for which authorization is being sought under the long-term transfer program and the WDCWA Water Agreement, Conaway could pump a maximum annual quantity of <u>45,000</u> acre-feet of groundwater. This would result in Conaway pumping nearly 3 acre-feet per acre of land. 2

While RD 108 has no objection to the provision of water to WDCWA through groundwater substitution, the cumulative impacts of Conaway's groundwater pumping for WDCWA and its groundwater pumping 2 for the long-term transfer program must be fully analyzed as required by the National Environmental Policy Act and the California Environmental Quality Act.

<u>RD 108 COMMENTS ON EIS/EIR</u>

1. <u>Impacts Analysis</u>: The EIS/EIR's analysis of the environmental impacts of the proposed groundwater substitution program is deficient in at least three respects:

    a. The EIS/EIR only includes an analysis of impacts related to groundwater pumping for Conaway's proposed 35,000 acre-feet/year groundwater substitution program. Because Conaway intends to pump an additional 10,000 acre-feet/year pursuant to its agreement with WDCWA, the impacts analysis on groundwater levels and land subsidence are artificially deflated.

    b. Measuring groundwater level drawdown at only one location on Conaway Ranch is inadequate given the magnitude of Conaway's proposed groundwater substitutions. (Draft EIS/EIR, at Figure 3.3-26.) As the EIS/EIR indicates, land subsidence has occurred at Conaway Ranch in the past. (Draft EIS/EIR, at 3.3-82.) Accordingly, the EIS/EIR should have analyzed more fully the land subsidence and groundwater level drawdown impacts in Conaway's area. Instead, the EIS/EIR analyzes impacts on groundwater levels and 3 subsidence in three locations far from Conaway, while relegating a hydrograph of the Conaway location (Location 30) to the Appendix with little analysis. (Draft EIS/EIR, at E-204-E210.) Moreover, as Exhibit 1 to this letter demonstrates, the effects of Conaway's groundwater pumping are already causing land subsidence. But instead of measuring conditions that have already occurred, the draft EIS/EIR relies on a simulation of Conaway's proposed pumping that does not take its current actions into account. Therefore, the final EIS/EIR should evaluate potential environmental impacts based on current conditions, rather than on a simulation in which the data set ends in Water Year 2003.

    c. Impacts from subsidence related to the Project and Project Alternatives are not presented in the EIS/EIR. This is a particularly important issue in relation to Conaway because Conaway has flood control levees adjacent to its property. One would expect that the increase in the magnitude of subsidence currently experienced at Conaway Ranch from existing pumping (which is not quantified or described in the draft EIS/EIR) would increase in relation to the expected groundwater level declines from the Project. Subsidence is often a delayed response to groundwater level declines and the proposed monitoring for subsidence is inadequate to assess longer term or delayed effects from subsidence that could occur after pumping for groundwater substitution has ceased.

2. <u>Mitigation Measures</u>: The draft EIS/EIR fails to adequately develop and explain how the potentially significant impacts of the project will be mitigated. Mitigation Measure GW-1 is insufficiently robust to reduce impacts from the proposed project to less than significant. In particular, the mitigation measures for land subsidence are inadequate. The mitigation measures proposed in GW-1 for land subsidence are not sufficiently set forth in the EIS/EIR. (See Draft EIS/EIR, at section 4 3.3.4.1.) Instead, GW-1 defers to a monitoring program to be developed in the future by the U.S. Bureau of Reclamation. Furthermore, the EIS/EIR states that areas with "higher susceptibility to land subsidence will also require more extensive monitoring" without specifying what that more extensive monitoring will involve. Mitigation Measure GW-1 also does not include any provisions for well replacement should well interference or longer term groundwater level declines result in

wells going dry and an inability for bowls or pumps to be lowered in response to Project impacts. Most importantly, the bulk of the mitigation responsibility falls on sellers, but the individual sellers' plans are nowhere to be found in the EIS/EIR. In short, the EIS/EIR claims that mitigation measure 4
GW-1 mitigates the potentially significant land subsidence effects without describing what the mitigation program actually entails. The final EIS/EIR should develop and analyze each of these aspects of the mitigation measure in greater detail.

3. <u>Cumulative Impacts Analysis</u>: The cumulative impacts analysis is inadequate in that it does not include an analysis of the WDCWA project. Moreover, the cumulative impacts of other reasonably 5
foreseeable groundwater development projects must be analyzed in the EIS/EIR.

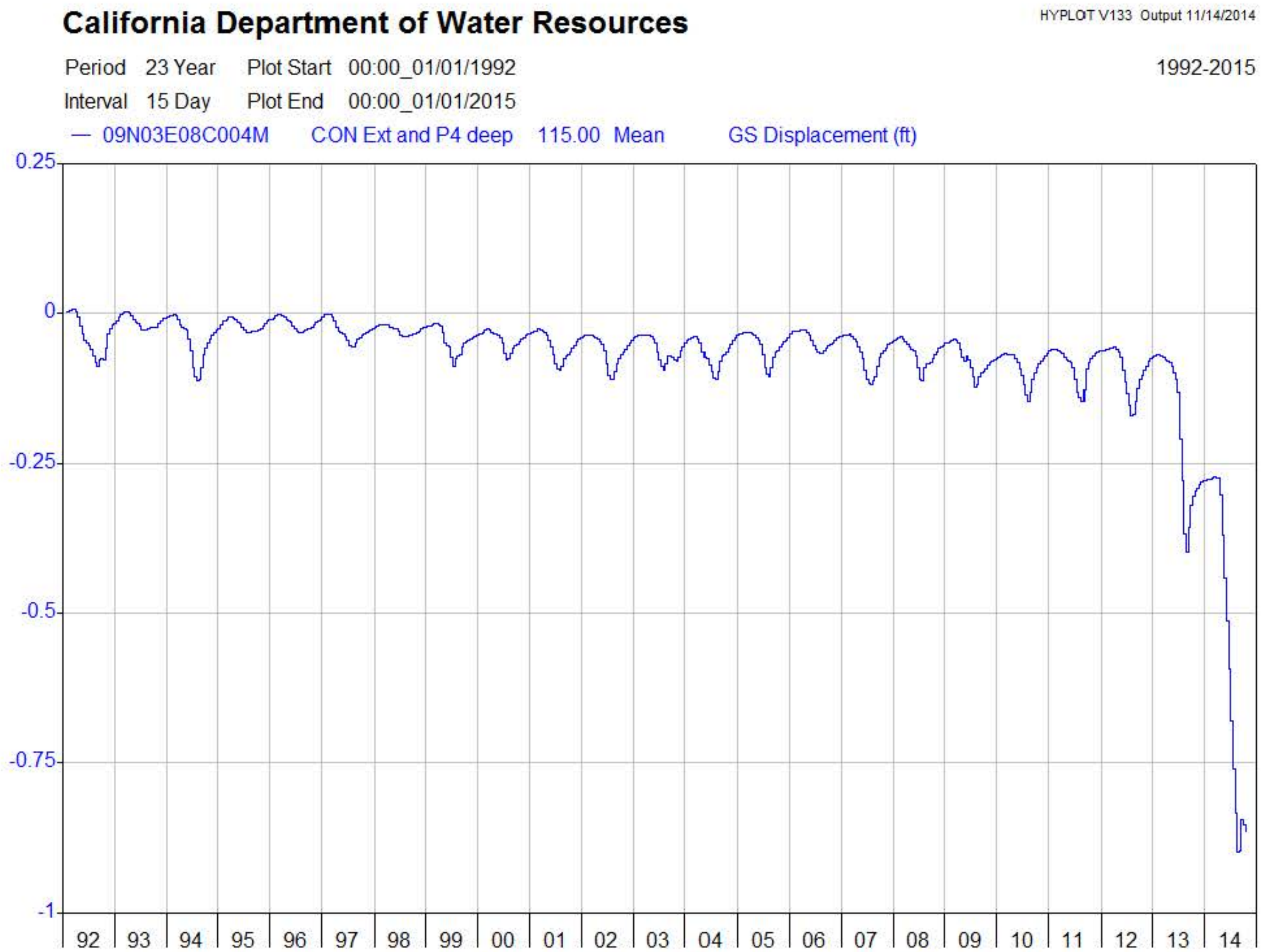
Thank you for the opportunity to submit these comments.

Sincerely,

Lewis Bair

Lewis Bair
General Manager

Enclosure


California Department of Water Resources
HYPLOT V133 Output 11/14/2014
Period 23 Year Plot Start 00:00_01/01/1992
1992-2015
Interval 15 Day Plot End 00:00_01/01/2015
— 09N03E08C004M CON Ext and P4 deep 115.00 Mean GS Displacement (ft)
0.25
0
-0.25
-0.5
-0.75
-1
92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14

SACRAMENTO METROPOLITAN
AIR QUALITY
MANAGEMENT DISTRICT

LA10

Larry Greene
AIR POLLUTION CONTROL OFFICER

November 25, 2014

SENT VIA EMAIL ONLY

Mr. Brad Hubbard
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Long-Term Water Transfers Draft Environmental Impact Statement/Environmental Impact Report (SAC201401523)

Dear Mr. Hubbard:

The Sacramento Metropolitan Air Quality Management District (SMAQMD) staff reviewed the Long-Term Water Transfers Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR). SMAQMD staff provides the following comment regarding the air quality section.

The EIS/EIR provides two measures to reduce air emissions from the project:

- AQ-1: Reduce pumping at diesel or natural gas wells to reduce pumping below significance levels, and
- AQ-2: Operate dual-fired wells as electric engines.

1

State CEQA Guidelines require mitigation measures to be fully enforceable through permit conditions, agreements, or other legally binding instruments (§15126.4(a)(2)). Additional details on how AQ-1 and AQ-2 will be implemented and enforced are necessary to ensure the emissions from the project will not have a significant impact to air quality.

Please contact me at 916-874-4881 or khuss@airquality.org if you have any questions. I look forward to receiving a notice when the final EIS/EIR is released.

Sincerely,

Karen Huss

Karen Huss
Associate Air Quality Planner/Analyst

Cc: Larry Robinson, SMAQMD
Carter Jessop, USEPA Region 9

LA11

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Santa Clara Valley Water District

December 1, 2014

Mr. Brad Hubbard, Project Manager
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Ms. Frances Mizuno, Assistant Executive Director
San Luis & Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635

Subject: Santa Clara Valley Water District's Comments on Draft Environmental Impact Statement/Environmental Impact Report for Long-Term Water Transfers

Dear Mr. Hubbard and Ms. Mizuno:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) prepared by the Bureau of Reclamation (Reclamation) and the San Luis & Delta-Mendota Water Authority (SLDMWA) for the proposed Long-Term Water Transfers Project (Project). The Santa Clara Valley Water District (SCVWD) understands that Reclamation is serving as the lead agency under the National Environmental Policy Act (NEPA) and that SLDMWA is serving as the lead agency under the California Environmental Quality Act (CEQA). These comments are provided by SCVWD for both NEPA and CEQA.

SCVWD respectfully requests that Reclamation and SLDMWA provide further discussion regarding the items identified below in order to more fully comply with NEPA, CEQA, and those laws' respective public disclosure and analysis requirements. SCVWD's comments relate primarily to the analysis of the Project's potential impacts to the San Felipe Division related to San Luis Reservoir (SLR).

1

Information provided in Section 3.2.2.4.2 (pp. 3.2-41 and 3.2-42) indicates that the projected SLR storage levels are lower under the Proposed Action. The Draft EIS/EIR recognizes that SLR storage "could decrease by as much as six percent (of water in storage in the No Action/No Project Alternative) during August of critical water years." Based on Table 3.2-27 on p. 3.2-42, monthly storage in SLR during a critical year could decrease by as much as 27,300 acre-feet (AF) between June and October, when SLR typically has the highest likelihood of reaching its lowest storage levels. The Draft EIS/EIR concludes that "potential storage-related effects on water quality would be less than significant for San Luis Reservoir." SCVWD would like more information to substantiate the statement that "these small changes in storage are not sufficient to … substantially degrade water quality." SCVWD would also like more information on whether deliveries to Santa Clara County could be impaired with the Project.

SCVWD relies on delivery of its Central Valley Project (CVP) water and other imported water supplies from SLR through the San Felipe Division. When SLR storage levels drop below an elevation of 369 feet, about 300,000 AF in storage or the "low point", algal blooms occurring during the summer can enter the lower intake of the Pacheco Pumping Plant and deliveries of

SCVWD's CVP supplies can be adversely affected; water quality within the algal blooms is not suitable for municipal and industrial water users relying on existing water treatment facilities in Santa Clara County. Deliveries to the San Felipe Division may be severely or completely interrupted when storage levels are drawn down such that there is insufficient hydraulic head to effectively operate Pacheco Pumping Plant. The EIS/EIR should provide more detail on the existing low point issue, and existing Reclamation operational protocols designed to minimize low point conditions. It should also provide greater analysis and detail on the impacts of the Project on SLR storage levels, and on SCVWD's water supplies due to low point conditions. 1

SCVWD thanks Reclamation and the SLDMWA for the opportunity to review and comment on the Draft EIS/EIR. SCVWD appreciates the Project's overall goal of increasing flexibility and reliability with regard to management of CVP water supplies. However, SCVWD requests that Reclamation and SLDMWA expand on the issues identified above in order to comply with CEQA and NEPA. SCVWD believes it is necessary to provide a more complete environmental analysis under NEPA and CEQA to help ensure that the Project does not provide a benefit to certain water providers to the potential detriment of others.

If you have any questions, please contact Cindy Kao at (408) 630-2346 or ckao@valleywater.org.

Sincerely,

Garth C. Hall
Garth Hall
Deputy Operating Officer
Water Supply Division

LA12

SOUTH DELTA WATER AGENCY

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December 1, 2014

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Mr. Brad Hubbard
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Re: Draft Environmental Impact Statement/Environmental Impact Report for Long-Term Water Transfers, Central Valley and Bay Area, California

Dear Mr. Hubbard:

The following comments and the attached comments are submitted on behalf of the South Delta Water Agency and the Central Delta Water Agency. Each of these agencies are charged with, and the surrounding lands dependent on good quality water in Delta channels for the protection of agricultural and other beneficial uses. Operations of the Central Valley Project and the State Water Project adversely affect flows, circulation, levels, and quality of water in the channels to the detriment of agricultural and other beneficial water users. By statute, regulation and permit, the United States Bureau of Reclamation ("USBR") and the Department of Water Resources ("DWR") are supposed to fully mitigate their impacts on such other uses as well as maintain various water quality standards intended to protect the Delta estuary and in-Delta users. The projects fail to meet these obligations on a regular basis and the proposed Long Term Transfer Project ("Project") may exacerbate DWR and USBR's continued failure to meet their obligations. SDWA and CDWA represent various water right holders who may be affected by the Project. 1

1. The Project in significant part appears to violate the language and spirit of CVPIA, the controlling federal statute for CVP-related water transfers.

In 1992, Congress passed and the President signed into law the Central Valley Project Improvement Act, commonly known as "CVPIA" or Public Law 102-575. The provisions of CVPIA fundamentally altered the operation of the CVP, requiring a dedication of water for fish and wildlife purposes, significant habitat and fish population goals and mandates and set forth new criteria for water transfers. CVPIA defined "Central Valley Project water" as "all water that is developed, diverted stored, or delivered by the Secretary in accordance with the statutes authorizing the Central Valley Project and in accordance with the terms and conditions of water rights acquired pursuant to California law." This broad description of CVP water importantly uses the word "or" to include virtually any water that gets from one place to another via the CVP, notwithstanding any water right under which the water might originally derive. 2

CVPIA also specifies the terms and conditions under which transfers of CVP water can be made. Section 3405 of the Act allows transfers of any CVP water "under water service or repayment contracts, water rights settlement contracts or exchange contracts. . . ." Thus, any individual or district which receives CVP water can transfer its CVP water if they or it comply with Section 3405.

Section 3405 (a)(1)(I) limits the transfers "to water that would have been consumptively used or irretrievably lost to beneficial use during the year of years of the transfer." The purpose of this provision is to ensure that a transfer of water does not increase the total amount of water consumed, rather it allows for the shifting of water use from one party to another. This is an important distinction. The transfers are meant to facilitate the movement of water to the highest use, or that use which can afford it especially in dry times. If the transfer criteria allowed the seller to continue to consume the same amount of water, then the system as a whole would be 2
consuming more water during dry times; an obviously counter-productive policy.

The Project being contemplated by USBR and others specifically allows the sellers to replace the transferred water through ground water substitution (see for example ES.3 - ES.4). Hence, the Project is by definition, at least in part contrary to the controlling statute under which the transfers are being contemplated. In the abstract, one could evaluate any transfer wherein the seller replaced the transferred water with another source and estimate the impacts and potentially mitigate the impacts. However, CVPIA as an expression of Congressional intent, has already made the determination that transfers dealing with CVP water shall not result in any total increase in use. Thus the draft EIS/R's analysis of what the impacts of such substitution might be and how they might be mitigated is irrelevant. No transfers which allow the seller to continue to consume any portion of the amount of water being transferred are legal.

It does not matter that the Project intends to allocate a portion of the transfer water to instream or ground water replacement. Any of the Project's transfers which are based on substituting ground water (or any other source) are prohibited under Public Law 102-575.

2. <u>Transfers under the Project which allow ground water substitution appear to violate CVPIA's mandate that any transfer have no significant impact on the seller's ground water.</u>

CVPIA Section 3405 (a)(1)(J) states that no transfer shall be approved unless it is determined that "such transfer will have no significant long-term adverse impacts on groundwater conditions in the transferor's service area." Although the draft EIS/R includes an analysis of impacts to ground water in proposed sellers' areas (see attachment hereto criticizing the DEIS/R analysis), it clearly concludes that specific impacts are not susceptible to 3
determination. Therefore the Project proposes significant monitoring to evaluate the actual effects on ground water levels, and subsequent measures to insure protection of the underlying basins. However, planning to evaluate the impacts of ground water substitution (or other methods of "funding" transfers) is clearly not a determination that any such transfer will have no significant long-term effects on the underlying basins. To comply with the provision of CVPIA, the Bureau would have to arrive at some level of certainty that actions like ground water substitution will indeed not adversely affect the transferor's basin. Future efforts at determining whether or not the basin will be affected are inadequate under the statute. Future mitigation does not insure no harm.

3. <u>The Project is contrary to and does not examine CVPIA's mandate to restore anadromous fish populations.</u> 4

Another provision of CVPIA requires the establishment of an anadromous fish restoration program, or AFRP. This program was developed and adopted by the Fish and Wildlife Service in consultation with the Bureau and other state and federal agencies. The program must double the populations of certain specified fish species. (see webpage http://www.fws.gov/sacramento /fisheries/ CAMP-Program/Home/Documents/Final_Restoration_Plan_for_the_AFRP.pdf) This program includes recommended higher flows on many rivers including various small and all the main tributaries to the Sacramento and San Joaquin Rivers (see webpage http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/docs/sjrf_spprtinfo/afrp_1995.pdf)

The amounts of flows recommended by the AFRP are significantly higher than currently mandated flows and would necessitate significant "new" sources of water. Since the precipitation in any particular year is finite, to get the increased flows for the AFRP program the Bureau (or FWS or NMFS) would need to purchase water from upstream interests, including not only those who operate other dams on various tributaries, but also current CVP contractors who claim rights to some of that additional supply.

The Project anticipates the transfer of water from the same supply from which AFRP water must come. Hence, the Bureau is moving forward with a program that will prevent it from meeting its federally mandated obligation to double anadromous fish. Although the Bureau may be allowed to move forward on numerous projects and activities at the same time, undertaking a "voluntary" project that will preclude it from meeting a federally mandated obligation is not proper or legal. At a bare minimum, the DEIS/R must examine how the proposed Project will, and to what extent, affect the success of the AFRP. Absent a detailed analysis of this renders the DEIS/R insufficient.

4. <u>The Project is contrary to and does not examine its effects on compliance with other federal law</u>. 5

In 2004, Congress passed and the President signed into law the "Water Supply, Reliability, and Environmental Improvement Act" (hereinafter "2004 Act") commonly referred to as HR 2828 or Public Law 108-361 (see webpage https://www.govtrack.us/congress/bills/108/hr2828/text). This statute mandates various duties to the Bureau and other federal agencies with regard to water issues and uses in California.

The 2004 Act required the Bureau to develop a plan to meet all existing water quality standards and objectives for which the(CVP) has responsibility (2004 Act Section 103 (d)(2)(D)(I)). The Bureau (which holds the State issued permits to operate the CVP in California) is assigned the responsibility for meeting numerous water quality standards/objectives. These objectives include not only Delta outflow or X2, but also water flow and quality standards on the San Joaquin River and in the southern Delta. The Bureau must meet fishery flow standards measured at Vernalis during various times of the year, and must meet salinity (measured in electrical conductivity, or EC) standards at Vernalis and at three locations in the southern Delta all year round. [The three interior compliance stations are Brandt Bridge on the San Joaquin, Old River at Middle River, and Old River at the Tracy Blvd. Bridge.] These various standards are set forth in the State Water Resources Control Board Decision D-1641 (see webpage http://www.swrcb.ca.gov/waterrights/board_decisions/adopted_orders/decisions/d1600_d1649/wrd1641_1999dec29.pdf).

Compliance with the fishery flow standards requires more water than the Bureau allocates from its reservoirs on the San Joaquin and its tributaries and thus compliance is dependent on there being water purchases. Compliance with the salinity standards also, to varying degrees, is dependent on flows in the river in excess of the amounts the Bureau allocates from its reservoirs. The 2004 Act states that as part of the Program to Meet Standards

> "The Secretary shall incorporate into the program the acquisition from willing sellers of water from streams tributary to the San Joaquin River or other sources to provide flow, dilute discharges of salt or other constituents, and to improve the water quality in the San Joaquin River below the confluence of the Merced River . . . and to reduce the reliance on New Melones Reservoir for meeting water quality and fishery flow objectives." (Section 103 (d)(2)(D)(v))

The Bureau has undertaken no effort to investigate, discuss or identify any willing sellers of water to comply with the above mandates of the 2004 Act nor done any environmental review of such mandatory transfers. Just as it has ignored the AFRP mandates, the Bureau has ignored these mandates and is now identifying potential sellers on the San Joaquin System to transfer water for export to CVP contractors. Again, the finite amount of water produced each year means that the Bureau is acting in a manner which precludes it from meeting federally mandated obligations contained in the 2004 Act. The DEIS/R make no analysis of how the Bureau intends to meet its permit obligations contained in D-1641 or how the Project might affect its ability to meet those obligations. As will be seen below, since the Bureau regularly violates its obligations to meet water quality standards its efforts associated with the Project are clearly frustrating not only the law, but in violation of the Bureau's permit and statutory obligations. 5

5. <u>By undertaking the Project, the Bureau is choosing to not meet is permit obligations to meet water quality standards, contrary to the assumptions in the DEIS/R.</u>

Since 2007, California has experienced two significant dry periods. 2007 and 2008 were a dry and an critical year. 2009 started off as being another critical dry year until some rains, especially in February eased the situation. 2012 was a below normal year with 2013 being one of the driest years on record. Those extremely dry conditions continued through 2014. In each of these dry periods, the Bureau (and DWR) were unable to meet their permit conditions for fishery and other water quality standards. The full extent of the hydrological conditions, reservoir operations and the lack of compliance with specific project obligations is too voluminous to repeat here. Reviewing the relevant SWRCB documents (see attached TUCP, http://www.swrcb.ca.gov/waterrights/board_decisions/adopted_orders/orders/wro2009.shtml) and the attached correspondence between CDWA and SWRCB provides a much more detailed summary. With that said, the following summarizes recent failures of the Bureau to meet its obligations. After a two year drought from 2007-2008, the Bureau, according to its own petition before the SWRCB, had insufficient water in storage to fully supply its highest priority contractor (the Exchange Contractors) and was unable to meet Delta outflow (X2) requirements beginning in early 2009. After a below normal year in 2012 and six months of virtually no precipitation in 2013, the Bureau was unable to meet and sought relief from it obligations to meet the Western Delta agricultural standard and the cold water requirements for Sacramento River fisheries. In 2014, as the drought continued, the Bureau was unable to meet outflow (X2), unable to meet cold 6

6

water requirements, unable to meet the spring Vernalis fishery pulse flow standard, unable to meet the Vernalis salinity standard, unable to meet the three interior southern Delta salinity standards and unable to meet the fall Vernalis fishery pulse flow standard. [See for example attached Notices of Violation and EC data from DWR webpage.]

7

This "drought-related" problem is unfortunately not just a function of droughts. The Bureau has also failed to meet the spring fishery pulse flow at Vernalis on a number of occasions and most every year violates the salinity standard at Old River at Tracy Blvd. Bridge. [See attached DWR 2013 and 2014 Water Quality Data] The underlying reason for the Project is to find additional supplies for CVP contractors during years when they do not get enough water under their CVP contracts. It is precisely those years that the Bureau is incapable of meeting its permit obligations to maintain water quality standards. However, instead of taking actions to meet its obligations, the Bureau instead embarks upon a program to find water to provide additional exports. Thus the Bureau has unlawfully elevated export contractor desire for additional water above the Bureau's existing obligations to protect fisheries and other beneficial uses. Although the Bureau's permits condition the delivery of water to its contractors on compliance with all other permit conditions, the Bureau consistently fails to do so. By undertaking the Project, the Bureau is insuring that not only will it not be able to meet its obligations in following years, but it is also making compliance even less likely and violations more severe. There is only so much water in the system. When the Bureau seeks to facilitate transfers of portions of the limited supply to satisfy contractor desires, it necessarily decreases the amount of water available to meet standards. It is important to note that in precisely the years when there is insufficient water to meet permit and other obligations for the protection of water quality, the Project will increase the consumptive use as a whole by allowing sellers to substitute their water supply to fund a transfer.

The DEIS/R purports to examine the Project's effects on stream flow and other waters, but it makes no analysis of how the Project will affect Bureau (and DWR) mandated obligations to meet water quality standards. The DEIS/R, like so many other environmental documents simply assumes that standards will bet met and ignores the reality of the water supply. As we have seen so clearly in the past 8 years, DWR and the Bureau operate to not meet the standards.

8

6. <u>The DEIS/R does not adequately examine the effects of the additional pumping on southern Delta water levels, quality or circulation.</u>

Export pumping at the SWP and CVP facilities in the southern Delta adversely affects flows, water levels and quality in the southern Delta and central Delta. [See attached 1980 Report of Effects of CVP]. The DEIS/R reasons that as long as the Bureau and DWR comply with their existing permit conditions and applicable SWRCB orders, no party is harmed. Thus additional projects, like the contemplated Project will also not cause third party harm. That is to say, if the current regulations on exports protects third parties, those same regulations will prevent any harm from any exports done under altered, but allowed exports. DWR and the Bureau intend to continue compliance with the regulatory scheme. Such assertions are incorrect.

Operations under current CVP permit conditions do cause harm. The SWRCB has *partially* addressed some of these third party impacts caused by the CVP and SWP in a Cease and Desist order issued against the projects (and subsequently amended). The Cease and Desist Order is WR Order 2006-0006 and its modification is WR Order 2010-0002, both can be found at http://www.swrcb.ca.gov/waterrights/board_decisions/adopted_orders/orders/wro2006.shtml. This Order places limits on export operations, including those wherein the Bureau would use

SWP facilities as is contemplated in the Project. The 2006/2010 Order requires the Bureau and DWR to develop water level and quality response plans, the latter of which requires the agencies to give notice of anticipated water quality violations and of actions undertaken to avoid such violations. The Order specifically lists the purchase of additional water for flow on the San Joaquin River as one potential mechanism to meet the standards. The Order also requires those agencies to give notice of actual violations and specify what actions were indeed taken to correct or minimize the violation. To date, DWR and USBR have generally failed to give the appropriate required notice and have taken no additional actions to prevent or minimize violations of water quality standards. The standards are regularly violated. 8

Levels.

The hydraulics of the southern Delta channels are very complicated and difficult to understand. In general, the operation of the SWP and CVP export pumps draw down local water levels to the point where it affects the ability of local diverters to operated their diversion pumps or siphons. The extent of the effects at any particular time are dependent on how much export pumping is occurring, inflow from the San Joaquin River, tidal flows, when (during the tidal cycle) the pumping is occurring, the existence of the temporary tidal barriers[1] and the depth and capacity of any particular channel. Although there is a "water level response plan" as required by the CDO as referenced above, that response plan only applies to times when the CVP is using the SWP pumps or vice versa (this use of the other's facilities is known as joint point of diversion, or JPOD). There is no response plan during other times, yet exports continuously adversely affect local diverters as the barriers are not a complete mitigation and are not installed and operated at all times. Even during times when the response plan is in effect, the practice of the Bureau and DWR is to operate in a manner that harms local diverters.

As can be seen in email and modeling charts provide by DWR/USBR in just this last month (see attached JPOD information), rather than comply with the mandatory seven-day notice requirement in the response plan, the projects "asked" to implement JPOD sooner than the mandated seven days. The modeling provided indicated that they intended to go forward with the JPOD since the water levels would be too low (adversely affect local diverters) anyway, and thus the JPOD was only a minor additional harm, and not significant. It is SDWA's position that when water levels are at the point where they adversely affect local diversions, no additional export pumping should be allowed as it only adds to the harm. None of this is mentioned must less analyzed in the DEIS/R. 9

This adverse impacts on levels from export pumping is graphically evidenced this past summer. When exports were at historic lows this summer, diverters along Tom Paine Slough had adequate water levels in the Slough. In all prior years, when exports were significantly higher, the Slough did not fully fill on the incoming tide and the diverters were often times incapable of diverting when needed. [See attached Tom Paine Slough data.] Under the Project, additional export pumping will occur, but the impacts to southern Delta diversions is completely unexamined. The DEIS/R is therefore insufficient for two reason. The first is that it makes no inquiry into how increased exports might affect southern Delta diverters ability to divert, and

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1 Three rock barriers are installed in the South Delta each year from approximately April through November. These barriers are meant to mitigate export effects on water levels by allowing incoming tides to fill the channels but then preventing the ebb tide from lowering water levels.

second, it wrongfully assumes that existing compliance with regulatory limitations on export 9
pumping means there is no harm caused by current export pumping levels.

Quality.

It is a similar situation with regards to water quality. First, the DEIS/R makes no mention of the impacts to EC at any of the three interior southern Delta compliance stations where the SWRCB Water Quality Control Plan objectives are measured. The DEIS/R does give information about changes at Vernalis, but again, ignores the three objectives downstream of Vernalis. As stated before, the hydraulics of the area are complicated. Southern Delta salinity (measured in EC) is a function of the salt which flows into the area from the San Joaquin River, local use, riverine evapo-transpiration, incoming tidal flows (and the salt contained therein), and
flow changes due to export pumping. As referenced above and in the attached materials, the 10
salinity standard measured at Old River at Tracy Blvd. Bridge is commonly violated.[2] The DEIS/R seems to accept these violations as a base case or accepted practice. By assuming this, the DEIS/R does not fully explain how the current conditions are causing harm to third parties or what or how the incremental effects of the project may also cause harm. The DEIS/R simply assumes current exports and additional exports under the Project do not affect third parties.

Importantly, the DEIS/R notes in Table 3.2.26 that water quality is sometimes worse under the Project at Clifton Court Forebay, the intake for the SWP export facility. If water quality is worse at this location, that means the dilution benefits of the incoming tide are less and the water quality upstream (where the three interior south Delta salinity standards are measured) is necessarily worse, and the resulting impacts unknown.

Circulation.

The DEIS/R has no analysis of how any changes in San Joaquin River flows or export levels will affect flow pattern in the southern Delta. As stated above, flows in the area are a function of many things including exports and inflow from the San Joaquin River. Even small changes in either one of these can have significant effects on flow patterns. This is true even during times when the tidal barriers are installed an operating. The barriers are designed and operated in a manner that provides the maximum protection from decreased water levels while
also trying to minimize salt from concentrating in the area. The barriers are most efficient at 11
certain levels of inflow as that inflow helps determine how much diluting tidal inflow will enter the area. A complete explanation of these issues is contained in the DWR documents at http://baydeltaoffice.water.ca.gov/sdb/tbp/index_tbp.cfm (The temporary barrier project site) and http://baydeltaoffice.water.ca.gov/sdb/sdip/index_sdip.cfm (The South Delta Improvement Program site which includes the final EIS/EIR for that project). The documents at these sites are incorporated herein as the underlying technical background of how the southern Delta flow is understood and barrier operations occur.

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2 The attached Salinity Measurements material shows DWR information indicating the measured EC at the four compliance stations as well as the 30-day running average. The standard is a 30-day running average of 1.0 EC (September - March) and 0.7 EC (April - August). Thus, any time the 30-day running average in the attached materials exceeds 1.0 EC from September - March or 0.7 EC from April - August there is a water quality violation.

7. <u>The DEIS/R does not adequately examine the impacts of transfers from the San Joaquin River system or how diversions of such transfers upstream of the Delta affect third parties.</u>

Table 3.2.25 on page 3.2.38 of the DEIS/R shows decreases in San Joaquin River flow under certain modeling conditions for various months in differing year types. Initially it must be noted that these numbers are averages for the year types. Though potentially helpful in analyzing impacts (assuming the modeling is correct and reliable) any average result is misleading because it mixes the lowest flow with the highest. Thus we cannot see what the lowest flow in any month is only the average of all flows from a set of years for that month. Impacts at these lower flows are therefore not examined and no conclusions should therefore be made about how the project may or may not injure third parties. 12

The information provided indicates that in some years San Joaquin River flows can decrease (for example) under the Project by up to 84 cfs in June and up to 81.3 cfs in March. These decreases can be significant in that flows on the River are sometimes very low. In the past year alone, Vernalis flow has dropped to 219 cfs in July (see attached DWR Flow Export data). Any change in such low flow would be very significant. Although the decreases in Table 3.2.25 are shown in above normal years, not knowing the flows in all years prevents us from determining if there are decreases in River flow during drier times under the Project.

The project also anticipates potential diversions of transfer water upstream of Vernalis and between Vernalis and the Delta proper (the later at the diversion of the Banta-Carbona District intake). The DEIS/R makes no real analysis of how such diversions would affect flow or water quality when the water enters the Delta (downstream of the Banta-Carbona intake). The San Joaquin River suffers from decreased flows (see 1980 Report attached hereto) and severe salinity problems due to drainage (surface and subsurface) from the CVP service area (see 1980 Report and Salinity in the Central Valley at
www.waterboards.ca.govcentralvalley/water_issues/salinity/central.

Much of the salt entering the San Joaquin River occurs upstream of the River's confluence with the Merced River. Generally, the Merced and other tributary flows downstream provide some dilution to the saline San Joaquin. Depending on where and when the Project might allow diversions along the River (of transferred water) determines the effects on the water quality of the water which eventually enters the Delta. As we have seen, the water quality standards in the Delta are often violated, which means that any change in salinity and flow could affect water quality especially at the locations where the violations occur. Both the amount of inflow and the load of salt are important given the manner in which the CVP and SWP cause salt to collect and concentrate in the southern Delta. In addition, New Melones dam/reservoir on the Stanislaus is used to control salinity on the San Joaquin River at Vernalis through releases. However, New Melones is not operated to meet the standards in the southern Delta. The DEIS/R must examine how any changes in flows due to diversions of transferred water upstream of the Delta (at Banta Carbona's intake and above) affect releases from New Melones and how it may affect interior southern Delta water quality. The DEIS/R does neither. 13

It is important to note that although the salinity standards are measured at four compliance locations, the standards apply throughout the channels at all locations (see SWRCB 2006 Water Quality Control Plan at page 10;
http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/wq_control_plans/2006wqcp/index.shtml

The DEIS/R does not even cover New Melones storage impacts which might occur due to changes in San Joaquin River flows or quality. Since the 2004 Act requires the Bureau to decrease New Melones use for meeting water quality standards, the DEIS/R is clearly incomplete and inadequate. 13

8. The DEIS/R is an improper "piecemealing" of a project under CEQA and NEPA.

According to the November 2013 Draft EIR/EIS for the Bay Delta Conservation Plan (BDCP), "Conveyance of transfer water by Authorized Entities is a covered activity provided that the transfers are consistent with the operational criteria described in CM1 and the effects analysis described in BDCP Chapter 5, Effects Analysis." (BDCP DEIR/EIS, p. 3-120; see excerpts enclosed herewith.) Because the BDCP will not only facilitate CVP water transfers, but will expressly include them as "covered activit[ies]," under CEQA and NEPA those transfers must be evaluated within the EIR/EIS for the BDCP and not in a separate, independent EIR/EIS.

With regard to CEQA, as the court explains in *Orinda Assn v. Board of Supervisors* (1986) 182 Cal.App.3d 1145, at page 1171:

> A public agency is not permitted to subdivide a single project into smaller individual sub-projects in order to avoid the responsibility of considering the environmental impact of the project as a whole. "The requirements of CEQA, 'cannot be avoided by chopping up proposed projects into bite-size pieces which, individually considered, might be found to have no significant effect on the environment or to be only ministerial.' [Citation.]"

As the court in *Berkeley Keep Jets Over the Bay Committee v. Board of Port Com'rs* (2001) 91 Cal.App.4th 1344, similarly explains: 14

> There is no dispute that CEQA forbids "piecemeal" review of the significant environmental impacts of a project. This rule derives, in part, from section 21002.1, subdivision (d), which requires the lead agency . . . to "consider[] the effects, both individual and collective, of all activities involved in [the] project."

Moreover, in a similar vein, as the California Supreme Court explains in *Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, at page 396:

> We hold that an EIR must include an analysis of the environmental effects of future expansion or other action if: (1) it is a reasonably foreseeable consequence of the initial project; and (2) the future expansion or action will be significant in that it will likely change the scope or nature of the initial project or its environmental effects.

CVP water transfers are indeed a "reasonably foreseeable consequence" of the BDCP (for among other reasons, they are in fact a "covered activity" under the BDCP), and those transfers will indeed "likely change the scope or nature of the initial project or its environmental effects." With regard to the latter, the November 2013 Draft EIR/EIS for the BDCP itself acknowledges that the scope of the BDCP would indeed change if CVP water transfers were added to the scope of that EIR/EIS. As that Draft EIR/EIS explains: "[T]he withdrawal of transfer waters from source areas is outside the scope of the covered activity." (BDCP Draft EIR/EIS, p. 3-120; see excerpts enclosed herewith.) Hence, if such withdrawal of transfer waters were included within that scope, it would undisputedly constitute a (significant) change of the scope of the BDCP Draft EIR/EIS (and, hence, its environmental effects). 14

For these reasons, the instant EIS/EIR is contrary to both CEQA and NEPA. The environmental analysis of the CVP transfers must be undertaken within the pending EIR/EIS for the BDCP and not separately from that EIR/EIS.

9. <u>The DEIS/R incorrectly assumes there will be no transfers from 2015-2014 absent the Project.</u>

On page 2-6 (section 2.3.1) and other places in the DEIS/R is it noted that the Base Case/No Action Alternative assumes no transfers during 2015 - 2024. There is no support for this 15
assumption. Even in this second year of significant drought, the Bureau and DWR conducted JPOD operations of transfer water (see attached JPOD). If such transfers occur under current conditions they will certainly occur sometime in the next 10 years under the Base Case. I note that per the language of CVPIA, any water that moves via CVP facilities is considered "CVP water" and thus comes under both the Project and CVPIA limitations.

10. <u>The DEIS/R is inadequate in that it is impossible to determine water savings under the crop shifting method of supplying transfer water.</u>

One of the methods of supplying transfer water is to account for the amount of water saved by a seller due to a shift of one crop to another that consumes less water. Since transfers are to provide supply in drier times, there is no way to know if the seller would have shifted to that crop anyway because of such drier times. In this past year the SWRCB curtailed all post-1914 water rights and publically considered curtailing pre-1914 water rights, riparian rights and even CVP and SWP contract rights (deliveries). Hence, the pressures of drought can and do affect farming decisions in all areas, including those identified as potential sellers under the Project. There is no 16
method to accurately determine if a seller would have shifted to a different crop absent a transfer, which makes the Project incapable of analysis and precludes any calculation of "how much water was saved."

This issue also is affected by the DEIS/R's failure to review water rights issues associated with any seller. If a seller is getting water from the CVP under a settlement or exchange contract, is the water he uses from his right or from the contract? Is he getting contract water in excess of what his underlying water right would provide under "natural conditions?" Is he making decisions on acreage and crops based on the contract or underlying water right? Does the decision on water use depend on what right is used? Until this morass of issues is resolved, there is no method by which one can determine if a crop shift actually results in more water being available.

11. <u>The DEIS/R incorrectly assumes the CV-SALTS process will decrease salt entering the southern Delta.</u>

One of the assumptions used to minimize, ignore or not examine the Project's impact on southern Delta salinity is that the CV-SALTS process will decrease the amount and concentration 17
of salts entering the San Joaquin River. This indicates a misunderstanding of the CV-SALTS process. CV-SALTS is a joint SWRCB, CVRQWCB and stakeholder effort to address the valley/River salt problems. Although the process is developing Basin Plan amendments which can/could limit discharges of salt, the main thrust of the effort is to find a way to get the valley

salts out to the Bay and Ocean. Hence, rather than decrease salt loads, the implementation of the Basin Plan will be through a real time monitoring/discharge program already being developed by the Bureau and stakeholders. Under such a program, Highly concentrated salts will be discharged to the River during times when the River is of better quality than the discharge, and such mixing will not exceed the standard. Hence, the plan is to spread the salts out over time so that times of better water quality will be degraded, not improved. The times when the concentration is already too high will not be affected as New Melones currently dilutes the River regardless of the salt concentration. In sum, the San Joaquin River will not improve under the CV-SALTS program, the salts will simply be spread out, degrading the River at all times. The same amount of salts will enter the south Delta as do now. Whether or not those salts will leave the area or be adequately diluted for local use remains unknown, unexamined and unplanned. (See webpage www.cvsalts.com.) 17

12. Additional comments and analysis are attached.

Attached hereto are more specific comments relating other portions of the DEIS/R, and a technical analysis done by E-Pur, LLC (engineering consultants) focusing mainly on the ground water/surface water modeling done in support of the DEIS/R. Each indicate that the DEIS/R inaccurately analyzes the impacts Project and/or does not use the best science available.

Very truly yours,

JOHN HERRICK

Long-Term Water Transfer Public Draft EIS/R Comments

EIS/R Document Comments

- Pg ES-1, par3 – There is no evidence to support or assure that Buyer's use will be beneficial. Application of water to lands with particularly high latent levels of selenium or boron which further directly degrade the San Joaquin River or cause degrading accretions to the San Joaquin River would not be beneficial.. 18
- Pg ES-1, par3 – There is no evidence to support or assure that the transfer water is not going to "service any new demands". Water used to irrigate new plantings of permanent crops or even an annual crop not yet planted is serving a new demand. As permanent crops mature water demand generally increases and constitutes a new demand. For M&I type uses new connections and increases in use of existing connections adds new demand. 19
- Pg ES-1, par4 – SLDMWA is the state lead agency. The SWP operations and facilities are an integral part of the proposed project implementation. DWR must operate the SWP to accommodate these transfers and will be responsible for identifying when excess capacities exist to create the transfer opportunity in the first place. DWR is also the permit holder for the right to operate the SWP that mitigate for the SWP operations. SLDWMA assistance in negotiating transfer agreements between parties is hardly a superior qualification for them as lead agency over DWR who has to operate the system to make the transfers happen. DWR should be the state lead agency. 20
- Pg ES-2, par2 – Other concurrent transfers must be considered for the projects affects on those operations, both directly and indirectly as well as in combination and cumulatively with them, e.g. Lower Yuba River Accord water transfers from YCWA. 21
- Pg ES-2, par4 - The Purpose and Need limits the consideration to transfers from upstream of the Delta to water users south of the Delta and in the San Francisco Bay. This improperly limits the objective consideration of all reasonable alternatives. Measures other than transfers and measures including transfers within the Buyer area or other parts of the State present reasonable alternatives.. 22
- Pg ES-2, par6 – Water transfers are only one potential method to meet supplemental water supply objectives. Water recycling, water conservation, and within water buyer district local conjunctive use, transfers, and land retirement are all other reasonable and effective alternative methods to satisfy this objective. 23
- Pg ES-2, par8 – The premise that the water transfers will occur to make up for regulatory constraint impacts on water supplies is fundamentally flawed. The failure of the projects to develop sufficient supplies to meet regulatory requirements, senior obligations and project contractor desires is the driver. Buyer's desire to acquire through water transfers water which is not truly surplus to the needs within the watersheds of origin. 24
- Pg ES-3, figure ES-1 – New Melones storage facilities and the Stanislaus River are identified as a potential conveyance for the proposed project, but no potential sellers have been identified in this watershed and no "Area of Analysis" (Table ES-2) was included for this geographic area. 25

Without a willing seller identified with New Melones water rights or water rights in the Stanislaus River basin, the New Melones facilities and the Stanislaus River should not be involved in the proposed project. This was not disclosed in the EIS/R. Since this geographic area and facility was not analyzed or impacts disclosed, the New Melones facilities and the use of the Stanislaus River cannot be covered under this environmental document or for agency decisions or permits issued based on this document. 25

- Pg ES-3, figure ES-1 – The figure and project description fail to identify the water conveyance routes that could be utilized (and which could precipitate different environmental impacts. Without identifying the route in which surface water flows would be affected by the project, there cannot be a proper project level impact analysis. Such impacts have not been adequately identified, characterized, evaluated, quantified, mitigated or disclosed. 26
- Pg ES-5, par ES 2.2 – The willing sellers are not described in any detail (like the buyers were), they were only included on a list. The map of willing sellers is not sufficiently detailed to determine who is where. As an example, the area south of the town of Davis cannot be determined as to who the land owner(s) may be. Regardless, no conveyance route to deliver the water for a transfer is identified or analyzed for this water transfer so the impacts for the transfers from this property are not disclosed in or covered by this environmental document. 27
- Pg ES-8, par ES 3.2 – Alternatives should have included all reasonable measures, including land retirement, within the Buyer area as well as areas of the State other than upstream of the Delta.. 28
- Pg ES-9, Table ES-3 – Crop shifting – crop shifting and idling appear to be used interchangeable in the document in terms of creating water supply, but the environmental impacts of them are significantly different in kind and magnitude. The analysis must clearly separate the location, timing, and magnitude of each of these water conservation strategies and address their separate types and magnitudes of impacts. 29
- Pg ES-9, Table ES-3 – Even with the improperly limited alternatives there should have been an alternative 5 which included all other water supply source concepts except seller service area crop idling and shifting so seller service area agricultural impacts from the water transfers could have been identified, characterized, quantified and disclosed. As the alternatives stand, all of the alternatives, except the no action, included seller service area agricultural conservation. This alternative must be included in the revised EIS/R so these impacts can be isolated and quantified and compared to the other alternatives. 30
- Pg ES-9, Table ES-3 – Even with the improperly limited alternatives there should have been an alternative 6 which included all other water supply sources except reservoir releases so reservoir release impacts from the water transfers could have been identified, characterized, quantified and disclosed. Isolating the impacts of storing and conveying water is essential to complying with the requirements of the Warren Act Contract assessment. As the current analysis stands, all of the alternatives except the No Action/No Project included reservoir releases so these CVP reservoir-related water wheeling related impacts cannot be separated from the other project impacts in order to satisfy Warren Act analysis requirements. 31

- Pg ES-9, Table ES-3 – Since most willing sellers identified are part of the CVP and SWP, these contractors will also be short on water allocations in years in which the buyers would want to do water transfers. Since the sellers would be short on water supply in these years, they would already be doing the feasible water conservation actions, shifting to less water consumptive crops, idling farmland and utilizing groundwater as an alternative water supply to their surface water rights. Therefore, the proposed project and other alternative which rely upon seller 32 service area water conservation, crop fallowing, crop shifting and use of alternative groundwater water supply assumptions are fundamentally flawed and unrealistic. Much of the water saving that the project is going to take credit for transfer would already be happening (switching to lower consumptive crops, idling land and switching to groundwater), so the project is claiming false credit for water conservation. The EIS/R must show, defensibly, how the water claimed as saved is actually saved, above and beyond what was going to happen absent the project.
- Pg ES-9,ES 4 par 2 – "The biological opinions on the Coordinated Operations of the CVP and SWP (U.S. Fish and Wildlife Service [USFWS] 2008; National Oceanic and Atmospheric Administration Fisheries Service [NOAA Fisheries] 2009) analyze transfers through the Delta from July to September (commonly referred to as the "transfer window") that are up to 600,000 AF in dry and critically dry years. For all other year types, the maximum transfer amount is up to 360,000 33 AF." This statement is correct as to the USFWS OCAP BO, but the NMFS OCAP BO has no similar provision or language. This erroneous assumption/representation distorts the EIS/EIR analysis of impacts to species covered in the NMFS OCAP BO.
- FWS OCAP BO pg 229, p1, "Water transfers would increase Delta exports by 0 to 360,000 acre-feet (AF) in most years (the wettest 80 percent of years) and by up to 600,000 AF in Critical and some Dry years (approximately the driest 20 percent years). Most transfers will occur at Banks (SWP) because reliable capacity is not likely to be available at Jones except in the driest 20 percent of years. Although transfers can occur at any time of year, the exports for transfers 34 described in this assessment would occur only in the months July-September." The proposed project transfers from April through June are not covered in the FWS OCAP BO impact assessment of water transfers so the proposed project water transfers that would occur in April through June must seek ESA consultation from FWS.
- FWS OCAP BO pg 229, p1, "Delta smelt are rarely present in the Delta in these months, so no increase in salvage due to water transfers during these months is anticipated, but as described above, these transfers might affect delta smelt prey availability." This is why the FWS OCAP BO 35 analysis of impacts of CVP and SWP water transfers in July through September are covered by the current take permits and any other months are not.
- FWS OCAP BO pg 229, p4, "The pumping capacity calculated is up to the allowable E:I ratio and is limited by either the total physical or permitted capacity, and does not include restrictions due to ANN salinity requirements with consideration of carriage water costs." So the 36 transferred water is allowed to degrade water quality because the flows to maintain salinity standards would cost too much?
- FWS OCAP BO pg 230, p1, "For all other study years (generally the wettest 80 percent) the available capacity at Banks for transfer ranges from about 0 to 500 TAF (not including the 37 additional 60 TAF accruing from the proposed permitted increase of 500 cfs at Banks. But, over the course of the three months July-September other operations constraints on pumping and

occasional contingencies would tend to reduce capacity for transfers. In consideration of those factors, proposed transfers would be up to 360 TAF in most years when capacity is limiting." The project description of the proposed project is not specific as to how much of the potential 511,000+AF are proposed to be transferred by water year type. Therefore, the project description is inconsistent with the limitations for water transfers set in the FWS OCAP BO. 37

- FWS OCAP BO pg 230, p3, "for this assessment proposed exports for transfers (<u>months July-September only</u>) are as follows:

Water Year Type	Maximum Amount of Transfer
Critical	up to 600 kaf
Consecutive Dry	up to 600 kaf
Dry after Critical	up to 600 kaf
All other Years	up to 360 kaf"

  Note that the FWS OCAP BO addresses these transfer amounts only during the period of July through September. 38
- NMFS OCAP BO pg 729 p3, "...this consultation does not address ESA section 7(a)(2) compliance for individual water supply contracts. Reclamation and DWR should consult with NMFS separately on their issuance of individual water supply contracts, including analysis of the effects of reduced water quality from agricultural and municipal return flows, contaminants, pesticides, altered aquatic ecosystems leading to the proliferation of non-native introduced species (*i.e.*, warm-water species), or the facilities or activities of parties to agreements with the U.S. that recognize a previous vested water right.", The NMFS OCAP BO appears to provide that <u>the water transfer seller and recipient agencies will require ESA consultation.</u> 39
- Pg ES-10, ES 4.1 – Specific measures are not set forth to assure that the Seller substitutes groundwater for surface water.. 40
- Pg ES-10, ES 4.2 – "Reclamation would limit transferred water to what would not have otherwise been released downstream absent the transfer." Specific measures to assure that this is the case are not spelled out. 41
- Pg ES-10, ES 4.2 – "Each reservoir release transfer would include a refill agreement between the seller and Reclamation (developed in coordination with DWR) to prevent impacts to downstream users following a transfer." "Refill of the storage vacated for a transfer may take more than one season to refill if the above conditions are not met in the wet season following the transfer." The reduction in storage from the transfer, that according to the document could take years to replace, could cause significant impacts to downstream users, reservoir resources (recreational boat launch access and marinas, warmwater fisheries reproduction success, 42 exposure of sensitive archaeological sites in the reservoir fluctuation zone and other significant impacts). The project must only be allowed to release water it has already stored, not release water that it does not yet have as appears to be proposed by the project. If the project is only allowed to release water it has already stored then the impacts to other resources are dramatically reduced. If the release only of water that is already stored is not a part of the project description, it must be a requirement for mitigation of the impacts caused by releasing water before it is stored.
- Pg ES-11, ES 4.3 – If weed cover is not removed then the consumptive use conservation the project claims to be using for the water transfer is not supportable.. 43

- Pg ES-11, ES 4.3 – Consideration must be given to protecting adjacent properties from herbicide spray drift and weed pressure from fallowed adjacent fields. Mitigation should include monitoring and funding to address these significant project impacts. 44
- Pg ES-11, ES 4.4 – "Transfer water generated by crop shifting is difficult to account for. Farmers generally rotate between several crops to maintain soil quality, so water agencies may not know what type of crop would have been planted in a given year absent a transfer. To calculate water available from crop shifting, agencies would estimate what would have happened absent a transfer using an average water use over a consecutive 5-year baseline period. The change in consumptive use between this baseline water use and the lower water use crop determines the amount of water available for transfer." Due to the speculative aspects of the determination of true water savings this alternative should be deleted. 45
- Pg ES-12, ES 5 – "The No Action/No Project Alternative considers the potential for changed conditions during the 2015-2024 period when transfers could occur, but because this period is relatively short, the analysis did not identify changes from existing conditions." Based on this quote from the document, the No Action/No Project baseline is incorrectly defined. The current OCAP Biological Opinions of NMFS and FWS include many Reasonable and Prudent Alternatives and Actions that the CVP and SWP must legally implement during this period. Some of these actions, e.g. bypass flows to inundate floodplain habitat and fish passage, have flow and operational implications that must be included in the No Action/No Project that do not exist (other than current legal obligation) in the Existing Conditions. The EIS/R analysis must be revised to correct for this error in the definitions of the baselines for comparison. 46
- Pg 1-2, 1.1.2 - A project objective identified is, "Develop supplemental water supply for member agencies during times of CVP shortages to meet existing demands. " New plantings, the maturing of already planted crops, new service connections in M&I areas and increased use of existing service connections are examples of new demand. The analysis is inconsistent with this objective and there are no significant measures to preclude increased reliance on diversions from the Delta. 47
- Pg 1-2, 1.1.2 – "Because shortages are expected due to hydrologic conditions, climatic variability, and regulatory requirements, transfers are needed to meet water demands." As pointed out in other comments, the regulatory requirements constrain CVP/SWP operations and when CVP/SWP operations are constrained by regulations there is no excess capacity to support water transfers. This component of the project objectives is not satisfied by any of the project alternatives. 48
- Pgs 1-10 & 11,1.3.1 – "According to the CVPIA Section 3405(a), the following principles must be satisfied for any transfer."... "Transfer will not adversely affect water supplies for fish and wildlife purposes. " The impact analysis in the EIR/S identifies several adverse, significant and less than significant proposed project and project alternative impacts to water supplies for fish and wildlife purposes both before and after mitigation. The statute does not limit affects based on significance. The proposed project and its alternatives are in violation of the CVPIA Section 3405(a). 49
- Pg 1-11, 1.3.1.2, – "The biological opinion concluded that continued long term operations of the CVP and SWP, as proposed, were "likely to jeopardize" the continued existence of delta smelt without further flow conditions in the Delta for their protection and the protection of 50

designated delta smelt critical habitat." As identified in other comments, reverse Old and
Middle River flow limitations, X2 and net delta outflow requirements of the FWS OCAP BO RPAs
have (theoretically) been implemented, but other required RPAs such as restoration of delta
smelt habitat have not been implemented and are obviously not on schedule for compliance.
FWS OCAP BO Action 6, "A program to create or restore a minimum of 8,000 acres of intertidal
and associated subtidal habitat in the Delta and Suisun Marsh shall be implemented." "The 50
restoration efforts shall begin within 12 months of signature of this biological opinion and be
completed within a 10 year period." Reclamation and DWR do not appear to have met this
requirement in that they have not completed project specific designs for these actions, started
project specific EIS/R environmental documents or initiated the permitting or contracting
processes to implement this action that is required to be implemented by 2018. Since
Reclamation and DWR have failed to implement this RPA, then the species are still in jeopardy
and the proposed water transfers would only further exacerbate the conditions that led to the
original FWS jeopardy opinion.

- Pg 1-11, 1.3.1.2, – "The USFWS developed a Reasonable and Prudent Alternative (RPA) aimed at
protecting delta smelt, improving and restoring habitat, and monitoring and reporting results."
Reclamation and DWR have not implemented and complied with many of these RPAs and have
missed the deadlines for submitting plans, reports, implementations and accomplishing the 51
specific goals of most of the RPAs. Since DWR and Reclamation have not implemented most of
the protections that were designed to protect the ESA listed species for jeopardy, the proposed
water transfers will only add to and exacerbate the impact of the CVP and SWP operations on
those species, which could only result in further jeopardy to these species.
- Pg 1-11, 1.3.1.2, – "(NOAA Fisheries 2009). This biological opinion concluded that continued
long term operations of the CVP and SWP, as proposed, were "likely to jeopardize" the
continued existence of Sacramento River winter run Chinook salmon, Central Valley spring run
Chinook salmon, Central Valley steelhead, and the southern Distinct Population Segment of
North American green sturgeon and were "likely to destroy or adversely modify" designated or
proposed critical habitat of these species. NOAA Fisheries also concluded that CVP and SWP
operation both "directly altered the hydrodynamics of the Sacramento-San Joaquin River basins
and have interacted with other activities affecting the Delta to create an altered environment 52
that adversely influences salmonid and green sturgeon population dynamics." The biological
opinion identified an RPA to address these issues and protect anadromous fish species."
Reclamation and DWR have not implemented and complied with many of these RPAs and have
missed the deadlines for submitting plans, reports, implementations and accomplishing the
specific goals of most of the RPAs. Since DWR and Reclamation have not implemented most of
the protections that were designed to protect the ESA listed species for jeopardy, the proposed
water transfers will only add to and exacerbate the impact of the CVP and SWP operations on
those species, which could only result in further jeopardy to these species.
- Pg 1-12, 1.3.1.2, – "The Opinions included the following operational parameters applicable to
water transfers: A maximum amount of water transfers is 600,000 AF per year in dry and critical 53
dry years. For all other year types, the maximum transfer amount is up to 360,000 AF." This
EIS/R statement is incorrect with regard to the NMFS BO.
- Pg 1-12, 1.3.1.2, – "Transfer water will be conveyed through DWR's Harvey O. Banks (Banks)
Pumping Plant or Jones Pumping Plant during July through September unless Reclamation
and/or DWR consult with the fisheries agencies." The operations of the proposed project may 54
not be altered from what is proposed, analyzed and disclosed in this environmental document
or the modification of the BOs must be subjected to subsequent piecemealed environmental
analysis of altered impacts.

- Pg 1-12, 1.3.2, – "Several sections of the California Water Code provide the SWRCB with the authority to approve transfers of water involving post-1914 water rights." Since almost exclusively post-1914 water rights would be transferred under the proposed project, all of the applicable SWRCB and CVRWQCB codes must be disclosed. Reference to and compliance with the applicable Basin Plans must be evaluated in the EIS/EIR. 55
- Pg 1-12, 1.3.2,, – "Section 1725 defines consumptively used water as "the amount of water which has been consumed through use by evapotranspiration, has percolated underground, or has been otherwise removed from use in the downstream water supply as a result of direct diversion." Evapotranspiration is defined as "the sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and waterbodies." (Wikipedia) When crops are reported by the universities on their total consumptive use to complete a crop cycle, these water use calculations include the water that is resident in the soil profile at planting from natural precipitation and precipitation that occurs during the crop growth cycle. The EIS/R analysis appears to take credit for saving the entire consumptive use of a crop as estimated by the universities. The project fails to take into account in their water savings calculations that a significant fraction of the water consumption for a crop is not saved by simply not planting the crop. Soil and water surface evaporation from precipitation still occurs even if the crop is not there. A certain amount of precipitation that falls is leached below the soil root zone and is lost to groundwater and that occurs if the crop is planted or not. The proposed project and the EIS/R analysis has made an error in taking credit for water saved for the entire evapotranspiration attributed to a crop when the fallowing of a field (provided it is kept free of vegetation) only saves the crop "transpiration" component of the water consumption attributed to a crop, not the "evaporation" component of water consumption that happens whether the crop is planted or not. The water savings credited for water transfer used by the project for "crop idling" and "crop shifting" are wrong and must be corrected to reflect the continued loss of water through evaporation and natural percolation to groundwater. Even the amount of groundwater substitution actually occurring from foregone surface water diversions is wrong in the EIS/R because of the mistaken project use of the entire evapotranspiration associated with a crop. Only the irrigation component of the crop's total evapotranspiration reported by the university would be saved by the groundwater conjunctive use. The natural precipitation component of the universities reported crop consumptive use would not be saved by the groundwater substitution and cannot be credited to water savings for water transfers as the EIS/R water accounting has proposed. This significant error in the water savings from crop idling, crop shifting and groundwater conjunctive use distorts the analysis and minimizes the impacts to ground and surface water. 56
- Pg 1-18, 1.5, – "Alternatives considered in this EIS/EIR only analyze transfers of to CVP contractors that require use of CVP or SWP facilities. SWP contractors may also transfer water originating north of the Delta to areas south of the Delta. The cumulative analysis evaluates potential SWP transfers, but they are not part of the action alternatives for this EIS/EIR." As a result of this statement and how the alternatives have been formulated and analyzed, no SWP contractor can sell water to the project proponents regardless of whether they use CVP or SWP conveyance to deliver it. Only sales of or from CVP contractors that are delivered through the CVPor SWP to the project proponents are covered by this EIS/R or any agency decisions or permits that are issued based on this EIS/R. 57

- Pg 1-18, 1.5, – "Buyers and sellers must prepare transfer proposals for submission to Reclamation. Proposals must also be submitted to DWR if the transfers require use of DWR facilities or the transfers involve a seller with a settlement agreement with DWR." The EIS/R fails to define what information must be included with the transfer proposal. 58
- Pg 1-18, 1.5,– "Reclamation reviews transfer proposals to ensure they are in accordance with NEPA, CVPIA, and California State law." This statement fails to include that Reclamation must also consider Warren Act Contract requirements when federal facilities are wheeling non-federal water (seller or buyer) through federal facilities. A Warren Act Contract Water Wheeling Assessment is required for any non-federal water from either transfer source or recipient that uses any CVP facility. This would appear to include use of San Luis Reservoir even if only SWP conveyance was used. 59
- Pg 1-18, 1.5, – "DWR may also be involved in conveying water for transfers and is interested in verifying that water made available for transfers does not compromise SWP water supplies. For water conveyed through the SWP system, DWR must also determine if the transfer can be made without injuring any legal user of water and without unreasonably affecting fish, wildlife, or other instream beneficial uses and without unreasonably affecting the overall economy or environment of the county from which the water is being transferred." It should be made clear that DWR will be required to develop and approve a separate environmental document for any water transfers that use SWP facilities. San Luis Reservoir is a joint SWP facility so use of these facilities, even if other SWP facilities or water are not involved, should result in the requirement of a separate environmental document from DWR.. 60
- Pg 1-18, 1.6, – The EIS/R omitted that if the project proposes to use SWP facilities DWR has decisions it must make. DWR must decide if there is available capacity, if they will conduct the transfer, and they do decide to do the transfer, they must do an EIS/EIR as the SWP transfers are not covered under the proposed project or any of the project alternatives (see EIS/R section 1.5 and the related comment). 61
- Pg 2-4, Table 2-1 – Ag conservation in the Buyer Service Area was inaccurately screened. Some types of ag conservation can be immediate, as an example, crop switching and improvements in irrigation scheduling or irrigation system distribution uniformity. Some ag conservation can be nearly immediate, such as improvements to irrigation systems to more water efficient types, e.g. sub-surface drip instead of flood furrow. Each of these ag conservation examples "provides water" for transfer within the buyer area. 62
- Pg 2-4, Table 2-1 – The alternatives considered failed to include: Increase water conservation for municipal and industrial uses in Seller Service Area to reduce water demands. It would have provided immediate and flexible water supplies as the buyer service area alternative concept to this option determined, but also would have provided water. 63
- Pg 2-4, Table 2-1 – The determination that reuse of water for ag was not possible for immediate implementation does not appear supportable. This option requires more full investigation for feasibility and consideration in a fair and evenly applied alternatives screening process. 64
- Pg 2-4, Table 2-1 – Permanent land retirement could be immediate and provides water. It seems a logical compliment to the other concepts of fallowing and crop switching. Permanently retiring marginal farmland has less of an impact than fallowing productive ground. Permanent retirement of land would allow that land to be restored to wildlife habitat. There is no 65

significant habitat value to the fallowed field kept free of vegetation as compared to one that is farmed or one that is permanently retired. Retiring land in the buyer service area is part of the No Action/No Project, including additional permanent land retirement in the buyer area should be part of one of the project alternatives.. 65

- Pg 2-4, Table 2-1 – Purchasing water entitlements in the Buyer area is as immediate and creates just as much water as the proposed project long term water transfers. This alternative concept must be fully evaluated in the revised EIS/R. 66
- Pg 2-4, Table 2-1 – Groundwater substitution should equally apply to the buyer area in the project alternatives. 67
- Pg 2-4, Table 2-1 –The characterization that not applying rice decomposition water does not result in saving (providing) water is unsupportable. Approximately 350,000 acres of rice is flooded for rice straw decomposition (http://www.arb.ca.gov/cc/capandtrade/protocols/rice/pbcs-12-20-13.pdf) and this flooding consumes approximately 175,00AF of water. There are several viable alternatives to applying rice decomposition water including rice straw baling and application of inputs to speed rice stubble decomposition. There are commercially available agricultural inputs that are designed to speed crop residue decomposition (https://www.soiltechcorp.com/product/stubble-digest/, http://www.midwestbioman.com/biocat.htm). Rice straw decomposition loads can be significantly reduced by baling and removing the rice straw (http://calrice.org/pdf/Sustainability+Report.pdf) and is used for erosion control (water quality benefits), cattle feed and power cogeneration (greenhouse gas emission benefit). The best part about this water conservation option (other than the fact it is immediate, flexible and provides water) is that the impacts are beneficial on the local communities by actually increasing the number of jobs rather than destroying them as crop idling does. This project alternative is too good of an opportunity not to be included as an alternative and must be included in the revised EIS/R. 68
- Pg 2-4, Table 2-1 –Transfer of water stored in CVP or SWP reservoirs should be considered? 69
- Pg 2-4, Table 2-1 –Transfer of water within a buyer area provides water. This alternative and transfers from areas of the State other than upstream of the Delta should be analyzed. 70
- Pg 2-4, Table 2-1 –Developing groundwater wells within a buyer service area provides water and implementing them is fairly immediate. This alternative should be analyzed. 71
- Pg 2-4, Table 2-1 – The EIS/R must include an alternative that includes continuation of one year transfers. 72
- Pg 2-7, 2.3.1, – The No Action/Project should have included the assumption that single year water transfers would still have occurred absent the proposed project. The lack of the implementation of the proposed project or alternatives does not preclude these single year transfers so the project analysis must be revised to correct the current flawed baseline assumption. 73
- Pg 2-9, 2.3.2.1, – "A similar case regarding the NOAA Fisheries biological opinion is before the court. If new biological opinions are completed, the new biological opinions or the findings of the NEPA analysis could change the quantity or timing of transfers. If the 74

biological opinions alter the timing and quantity of transfers, the Lead Agencies will determine if supplemental environmental documentation is necessary to address any 74
changes in potential impacts." An alternative for continuing with short term transfers should be included.

- Pg 2-11, Figure 2-3 – The figure shows water transfers starting approximately May – June (when the lines are diverging), but the FWS OCAP BO only allows transfers from July – September. 75
- Pg 2-11, 2.3.2.1, – "The seller could request that Reclamation store the non-CVP water in the CVP reservoir until Delta capacity is available, which would require contractual approval in accordance with the Warren Act of 1911." This statement indicates, as an example, that PCWA could sell water from its' reservoir, PCWA would release the water when they needed to into their tributary, Reclamation would release less water from Shasta into the Sacramento River during the PCWA release and make the saved Shasta reservoir water available for transfer for the project later in the season. There are multiple fisheries impacts in both tributaries and downstream of them from these interbasin proposed changes in 76
water operations. These inter-basin operational changes to proposed project impacts include changes to water temperature suitability for coldwater fisheries resulting in adverse modification of critical habitat for ESA species, increased fish mortality and reduced fecundity; altered attraction flows and water temperatures for migrating fish causing straying which in turn increases redd superimposition, prespawn mortality, reduced fecundity, egg mortality and genetic introgression. These are all serious significant impacts to endangered species that the EIS/R failed to identify, evaluate, characterize, quantify, mitigate or disclose. The EIS/R must be revised to include these impact analyses and to rectify these material deficiencies in this document.
- Pg 2-12, Table 2-3 – The table assumes that the amount of water saved for each crop is the same regardless if the crop is idled or it is shifted to another crop. If the field is shifted to another crop it will consume moisture from the soil profile and any precipitation that occurs 77
even if it is not actively irrigated. The water savings for shifting a crop is not the same as for idling a crop.
- Pg 2-12, Table 2-3 – The proposed project plan of crop shifting is fatally flawed for its vulnerability to gaming by the sellers. There is nothing in the proposed project to assure that 78
real water savings will be realized by crop shifting.
- Pg 2-12, 2.3.2.1, – "To calculate water available from crop shifting, agencies would estimate what would have happened absent a transfer using an average water use over a consecutive 79
five-year baseline period." The proposed project and the EIS/R analysis fail to provide any reasonable assurances that real water savings will occur to offset these proposed transfers..
- Pg 2-13, 2.3.2.2, - "Modeling analysis indicates that using hydrology from 1970-2003, transfers could occur in 12 of the 33 years." The project description, analysis and range of 80
permit conditions should be limited to the same type of water years used for the analysis.
- Pg 2-13, 2.3.2.2, - "Sellers that are not specifically listed in this document may be able to sell 81
water to the buyers as long as: the water that is made available occurs in the same water

shed or ground water basin analyzed in this EIS/EIR,..." Unless included within the scope of this EIS/R this would lead to piece-mealing project impacts. Also, New Melones Reservoir and the Stanislaus River were not included in the Areas of Analysis so according to this declaration in the EIS/R, no water from this basin can be included in future water transfers under this project. 81

- Pg 2-14, Figure 2-4 – Water transferred from Merced Irrigation District would have to flow down the San Joaquin River and other channels prior to being diverted by the CVP or SWP pumps in the south Delta or ther diversions. The EIS/R analysis did not take into account the amount of that water lost in transit. Evaporative losses and losses to groundwater are likely significant. This type of water loss in the transfer process is also true of all of the other water transfers to varying degrees depending on locations, transit path and times of year. As a result of the flawed assumptions of the EIS/R analysis, the project proposes to divert much more water than would actually be saved and understates the reduction in available water supply for other needs and the related impacts. As a result of the project taking too much credit for the amount of water transferred, the project would actually result in a net deficit of water in the delta and tributaries rather than the neutral flow impact the project analysis claims in the EIS/R. The impacts were not adequately identified, characterized, evaluated, quantified, mitigated or disclosed in the EIS/R. The EIS/R is flawed in its water conveyance loss assumptions and therefore deficient in its analysis and disclosure and must be revised. Attached is a copy of the May 24,2013 letter from the USBR and DWR to Tom Howard attempting to justify the April 28,2013 violation of the D-1641 salinity objective at Emmaton. The letter highlights a dramatic increase in overall rates of depletion to reservoir releases which "was simply not anticipated by project operators and is extreme from a historical perspective". The analysis for the EIS/R is based on the same project operator modeling as was used in the flawed 2013 project operations. Although diversions for rice cultivation were cited the impact of water transfers, depletions of streamflow due to groundwater pumping and interception of accretions to streamflow in the dry year are likely. The models used for the analysis should be subjected to peer review corrections made and the analysis revised accordingly. 82
- Pg 2-16, Table 2-5 – FWS OCAP BO pg 229, p1, "Although transfers can occur at any time of year, the exports for transfers described in this assessment would occur only in the months July-September." The analysis conducted in the FWS OCAP BO only addresses water transfers from July through September. Water transfers at any other time of year are not covered in the FWS OCAP BO, so the proposed project transfers in April – June are not covered under the current FWS OCAP Biological Opinion and are therefore not covered under the current CVP/SWP incidental take permits. Water transfers for any months outside of July – September must require additional ESA consultation with FWS. 83
- Pg 2-16, Table 2-5 - The reason that the water transfers covered under the FWS OCAP BO only covered July – September is that "Delta smelt are rarely present in the Delta in these months, so no increase in salvage due to water transfers during these months is anticipated, but as 84

described above, these transfers might affect delta smelt prey availability." (FWS OCAP BO pg 229, p1). So water transfers that occur outside of those months, such as the April – June transfers in the proposed project, would result in take as smelt would be present at the pumps. 84
The transfer impacts analyzed and approved in the FWS OACP BO specifically do not include the impacts that would occur from transfers during these other months. The Proposed Project and alternative must be revised to omit the April – June transfers or the project must seek ESA consultation with FWS for a Biological Opinion and incidental take permits that covers the impacts to delta smelt that would occur with water transfers in those months

- Pg 2-18, 2.3.2.3, - "Delta conveyance capacity would be available when conditions for sensitive species are acceptable to NOAA Fisheries and USFWS, typically from July through September, but groundwater substitution and cropland idling/crop shifting transfers would be available from April through September." If the south delta pumps of the CVP or SWP 85
are used in the April through June water transfers, regardless of the source or type of water credit being taken as the justification for the transfer, they will result in additional levels of ESA species take that was not covered under the FWS OCAP BO and therefore would require a new ESA consultation with FWS in order to occur. Appropriate environmental analysis for any changes would be required and should be a part of the EIS/R.
- Pg 2-18, 2.3.2.3, - "Reclamation would only consider storing water for transfers if it would not affect releases for temperature, or if it could be "backed up" into another reservoir (by reducing releases from that reservoir). Backing up water may be possible if the Delta is in balanced conditions and instream standards are met. The decision to back up transfer water would be made on a case-by-case basis, but storage is analyzed in this EIS/EIR so that the analysis is complete in the event Reclamation determines that storage is possible in a specific year." Backing up transfers "into another reservoir by reducing releases from that 86
reservoir" results in complex and significant fisheries impacts from water being released in one tributary at one time vs. a different tributary at a later time. In order for the permits based on this EIS/R to cover this proposed mode of operation of the proposed project, the analysis conducted in this EIS/R must cover the full range of operations proposed to be covered by this document and implemented by the project. The EIS/R claims an analysis of storing water in Shasta was conducted. Analyses for other affected reservoirs must also be conducted.
- Pg 2-18, 2.3.2.3, - "Sacramento River sellers and buyers would generally prefer water transfer options that are more flexible, such as starting groundwater substitution pumping 87
when Delta pumping capacity for transfers is available." The analysis is inadequate to include the broad range of impacts associated with such flexibility.
- Pg 2-18, 2.3.2.3, - "Proposed sellers divert water from various locations along the Sacramento River or the Sutter Bypass." The interrelationship of ground and surface water 88
in the seller areas is obvious and difficult to analyze and moniter. After the fact monitoring does not avoid the impact. The groundwater substitution alternative should be rejected.

- Pg 2-22, 2.3.2.3, - "The Canal experienced substantial losses during conveyance to vegetation along the Canal system. The conservation project replaced the Canal with a pipeline and reduced associated losses to vegetation, thereby creating water for transfers." Reducing vegetation is a critical factor in meaningful water savings., The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose any special status plants, fish or animal species that will be affected by the removal of this water source at the current leaks. Leaks could result in habitat supporting wetland plant communities and associated species. The project failed to mitigate for the wetland habitat that will be destroyed from fixing these leaks. Water from these leaks also would have contributed to adjacent stream flows which provide habitat for yellow and red legged frog, tiger salamander, and steelhead. In addition to the ESA species consultation with the fisheries and wildlife agencies for this action, the project also will need streambed alteration agreements, wetlands alteration, etc. from DFG, USACE and others. 89
- Pg 2-22, 2.3.2.3, - "Cordua ID would transfer water made available through groundwater substitution actions. This transfer would increase flows on the Yuba River downstream of Cordua ID's point of diversion (absent the transfer) during the transfer period." Groundwater and surface water interact. Groundwater wells, especially those physically located in proximity to a tributary, are hydraulically connected to the surface water. When a groundwater cone of depression intersects groundwater maintained by tributary surface flows, the cone of depression increases the rate of loss of surface flows to groundwater and bank recharge. In order to determine the actual increase in surface flows from the foregone diversion of surface water in favor of groundwater use, the location of each groundwater well and its situational relationship to surface water hydraulics must be analyzed. Irrigation district well fields tend to be in locations that are near their surface water diversion locations because the infrastructure to convey the surface water was there first and is required in order to deliver the pumped groundwater. This proximity of irrigation well fields being in proximity to irrigation surface water diversions was well documented in the Sacramento Valley Regional Water Plan "Phase 8" enviromental document. This comment and criticism of the incompleteness of the EIS/R analysis of groundwater substitution impacts on surface water flows applies to all of the proposed groundwater substitutions included in the proposed project and alternatives. This deficiency and undisclosed impacts must be corrected in the revised EIS/R. Similarly the overall lowering of the groundwater even from pumping long distances from the rivers and streams will increase losses from the surface flow. 90
- Pg 2-26, Figure 2-8 – "Water could flow down the Merced River into the San Joaquin River and be diverted through existing facilities within Banta Carbona ID, West Stanislaus ID, or Patterson ID (see Figure 2-8). " The NMFS and FWS OCAP BO analysis does not address this type of operation or these diversion locations for these purposes so the incidental take permits based on those BOs do not cover these operations.. 91
- Pg 2-29, 2.3.2.4 – A number of assurances are missing from this list. 92

- There must be assurances that the project changes in relative flows and water temperatures for all tributaries affected by earlier or later releases and increased or decreased tributary flows do not adversely affect migratory fish. Changes in flow proportions or relative water temperatures at a tributary confluence can increase salmonid straying. Straying causes increased competition for holding and spawning habitat and associated prespawn mortality and reduction of fecundity; redd superimposition and associated egg mortality and genetic introgression result in a loss of productivity and reductions in the genetic integrity and diversity of the species. 92
- There must be an environmental commitment to use the stored water to protect water quality to be compliant with all water quality standards prior to any water transfer water being delivered. DWR and Reclamation routinely deliver SWP and CVP water while concurrently violating water quality requirements, including adverse modification of critical habitat for ESA listed species, e.g. dissolved oxygen deficiency in delta smelt critical habitat. This water transfer operation must not be allowed to deliver any water unless all water quality requirements are met and in the event that current water quality requirements are not being met by the CVP/SWP regular operations, this transfer water must be used for these water quality protection purposes first, before transfer water can be delivered.
- Since Reclamation's requirement to comply with the CVPIA is a requisite for their approval of water transfers for the project, the project should include the CVPIA 3405 (a) limitation which provides water transfers cannot "adversely affect water supplies for fish and wildlife purposes" as an environmental commitment.

- Pg 2-29, 2.3.2.4, – "In groundwater basins where sellers are in the same groundwater subbasin as protected aquatic habitats, such as giant garter snake preserves and conservation banks, groundwater substitution will be allowed as part of the long term water transfers if the seller can demonstrate that any impacts to water resources needed for special-status species protection have been addressed. In these areas, sellers will be required to address these impacts as part of their mitigation plan." There are no sub-basins in the proposed seller areas that do not contain protected aquatic habitats. This commitment must be expanded to include all protected habitats that may be affected by the water transfers. Not all special status species are in aquatic habitat. As a very real example of a proposed project impact, the repair of the pipeline as a conservation action will impair habitat for red and or yellow legged frog. A protected aquatic habitat not only includes preserves or conservation banks, but also critical habitat as designated by the ESA. There are no seller area sub-basins that do not have any ESA designated critical habitat so all of the sellers must address these impacts as part of their mitigation plan. These mitigation plans must be part of and disclosed in this EIS/R unless these will be addressed in a separate EIS/R prepared by the sellers as part of their ESA consultation process. To avoid piecemealing the analyses should be included in this document. 93
- Pg 2-29, 2.3.2.4– "Carriage water (a portion of the transfer that is not diverted in the Delta and becomes Delta outflow) will be used to maintain water quality in the Delta." The 94

analyses must include a defensible calculation of the quantity of the transferred water that actually reaches the delta to contribute to transfers and delta water quality. There are surface water evaporation losses, and loss to groundwater percolation and interception of accretions that must be accounted for that the EIS/R analysis has overlooked. Each potential water conveyance route, with its associated loss rates for the time period of the water transfer must be accounted for in the EIS/R analysis. The EIS/R must be revised to address this material deficiency. 94

- Pg 2-29, 2.3.2.4, – "As part of the approval process for long-term water transfers, Reclamation will have access to the land to verify how the water transfer is being made available and to verify that actions to protect the giant garter snake are being implemented." Access to land does not assure compliance. Monitoring must be by a party without conflict, there must be a real enforcement mechanism and there must be funding for the enforcement effort.. Such assurances are not provided. 95

BUREAU OF RECLAMATION
Central Valley Operation Office
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DEPARTMENT OF WATER RESOURCES
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3310 El Camino Avenue, Suite 300
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MAY 24 2013

IN REPLY REFER TO:
CVO-100
WTR-4.10

Thomas Howard
Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, California 95814

Subject: April 2013 Exceedence of Salinity Objectives at Emmaton

Dear Mr. Howard:

On April 28, 2013, the Bureau of Reclamation and the Department of Water Resources (collectively the Projects) exceeded the D-1641 salinity objective at Emmaton. Project operations staff notified State Water Resource Control Board (SWRCB) staff of the exceedence by conference call on April 29, 2013, and by e-mail notification to the SWRCB. This letter provides formal notification of the exceedence and background information relevant to the circumstances.

Background information leading to exceedence conditions:

The exceedence of the 14-day running average of 0.45 EC salinity objective at Emmaton for a Sacramento Valley Dry Year type was caused by the interaction of two conditions: low river flows on the lower Sacramento River system culminating at Freeport, and increasing tides during the period of April 21, 2013, through April 25, 2013. Tidal trends and fluctuations are conditions generally anticipated by Project operators as part of salinity objective compliance; however, the low flow conditions on the lower Sacramento River system in late April 2013 was not anticipated by Project operators and is the main factor of the exceedences that have occurred at Emmaton.

Precipitation patterns for water year 2013 have been a scenario of extremes. The months of November and December produced significant rainfall and project reservoir storage correspondingly increased without any significant flood control releases from major project reservoirs. The calendar year precipitation, however, has been dismal. The accumulation of rainfall since January 1 for the long record of the Northern Sierra 8-Station Precipitation Index is approximately 8.8 inches. Currently, this value represents the driest calendar year period in the long precipitation record--even drier than the very dry single years of 1977 and 1924. Creek and small stream flows that enter the Sacramento River system below major reservoirs are running at historically very low levels in response to this long, dry precipitation period. (Attach 8SI plot)

Historically, the initial diversion for rice cultivation and ponding has generally occurred from late April to early May, depending on farmer cultivation and preparation practices and soil moisture conditions, to allow farmers to prepare their fields. Generally, project operators have observed this diversion to rice fields occur over several weeks from late April to early May, and have monitored river conditions and increased reservoir releases as rice cultivation diversion rates increased. It now appears that in 2013, due to the very dry hydrologic conditions since the first of the year, a very large portion of rice fields were cultivated and ready to begin their initial field flooding on a simultaneous schedule during the third week of April. This diversion to rice cultivation, although expected to occur, was unanticipated by Project operators for the sheer size and magnitude of simultaneous initial diversion for rice cultivation that actually occurred valley-wide.

Project operators responded to the increasing diversion rates during this period; by increasing reservoir releases in an attempt to catch up to the lower Sacramento River flow conditions. Figures 1 and 2 illustrate the Projects' reservoir release response to flow conditions in the lower Sacramento River during this period of unprecedented diversions. The first illustration shows Keswick's releases in response to the flow pattern at the Wilkins Slough river gage location. This section of the Sacramento River Basin is controlled exclusively with Shasta/Keswick reservoir releases with an approximate lagged travel time of 2.5 days between Keswick and Wilkins Slough. The second illustration indicates the reservoir releases in response to the flow pattern at the Verona river gage location. Verona flow is influenced by reservoir releases from Keswick Reservoir as well as Oroville Reservoir's releases to the Feather River. The approximate lagged travel time from Keswick is 3.5 days and just over one day from Oroville. Both illustrations show the dramatic increases from project reservoirs in response to low flow conditions observed along the lower Sacramento River. The dramatic increase in overall depletion rates experienced over a period of about ten days was simply not anticipated by project operators and is extreme from a historical perspective. Reservoir release rates of 11,000 cfs from Keswick Reservoir and 5,250 from Oroville Reservoir are more typical of late May than late April even in a dry condition. Folsom Reservoir releases were increased from 1,000 cfs to 1,250 cfs on April 25, 2013, to also contribute to lower Sacramento River flows.

The result of this unusual condition and timing is that Freeport flows entering the Delta were very low for a period of a week to ten days. (See Operational Report). At the same time, pulse flows were entering the Delta from the San Joaquin River at Vernalis as part of the annual pulse flow management from the San Joaquin River Basin. Due to the low flow conditions at Freeport, salinity conditions in the vicinity of Collinsville and Emmaton along the extreme lower Sacramento River and western Delta increased dramatically as tidal conditions increased. (See Operational Report). Project operators responded to the changing conditions by reducing scheduled exports that were anticipated to be near a 1:1 ratio with Vernalis flow in order to maintain Delta outflow conditions necessary to meet X2 objectives at Collinsville. Without adequate flows at Freeport to repel salinity conditions in the lower Sacramento River, salinity levels near Emmaton inevitably exceeded the dry year objective of the maximum 14-day running average of mean at 0.45 salinity. Project reservoir releases stabilized Freeport flows at greater than 10,000 cfs beginning April 28, 2013, and averaged above this rate until compliance of the 14-day 0.45 EC objective at Emmaton was re-established on May 19.

Challenges facing project operations for the remainder of year:
By D-1641 criteria, water year 2013 is classified as a "Dry" year as published in the last Bulletin 120 update for May 1st hydrologic conditions. As previously mentioned, water year 2013 has been a year of extremes with generally wet conditions in November and December and retention of storage in upstream reservoirs, followed by extreme and possibly record dry precipitation conditions since January 1. This pattern of hydrologic conditions will very likely bring challenges for the remainder of this water year. Reservoir storage in Shasta and Oroville is in reasonably good shape, but will be relied upon heavily under adverse hydrologic conditions to balance the goals of Sacramento Valley diversion/depletion, Delta objectives, water supply delivery, and coldwater management. Folsom Reservoir management will be challenged by the overall availability of water and limited coldwater availability. The hydrologic conditions of 2013 and the early advent of significant depletion rates in the Sacramento Valley may indicate that historic high levels of Sacramento Valley depletions are likely during this year's irrigation season. (Projecting seasonal Sacramento Valley depletions, as compared to projecting full natural river flows in Bulletin 120, could be a difficult extrapolation from historic values, and uncertainty in depletion values is always a challenge to project operations.)

If you have any questions or would like more information regarding this notification, please contact Mr. Paul Fujitani of Reclamation at 916-979-2197 or Mr. John Leahigh at 916-574-2722.

Sincerely,

Ronald Milligan

Ronald Milligan, Operations Manager
Central Valley Operations Office
U.S. Bureau of Reclamation

for D. Roose

David H. Roose, Chief
SWP Operations Control Office
Department of Water Resources

Attachment -2

cc: See next page.

cc: Mr. John Herrick, Esq.
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FIGURE 1

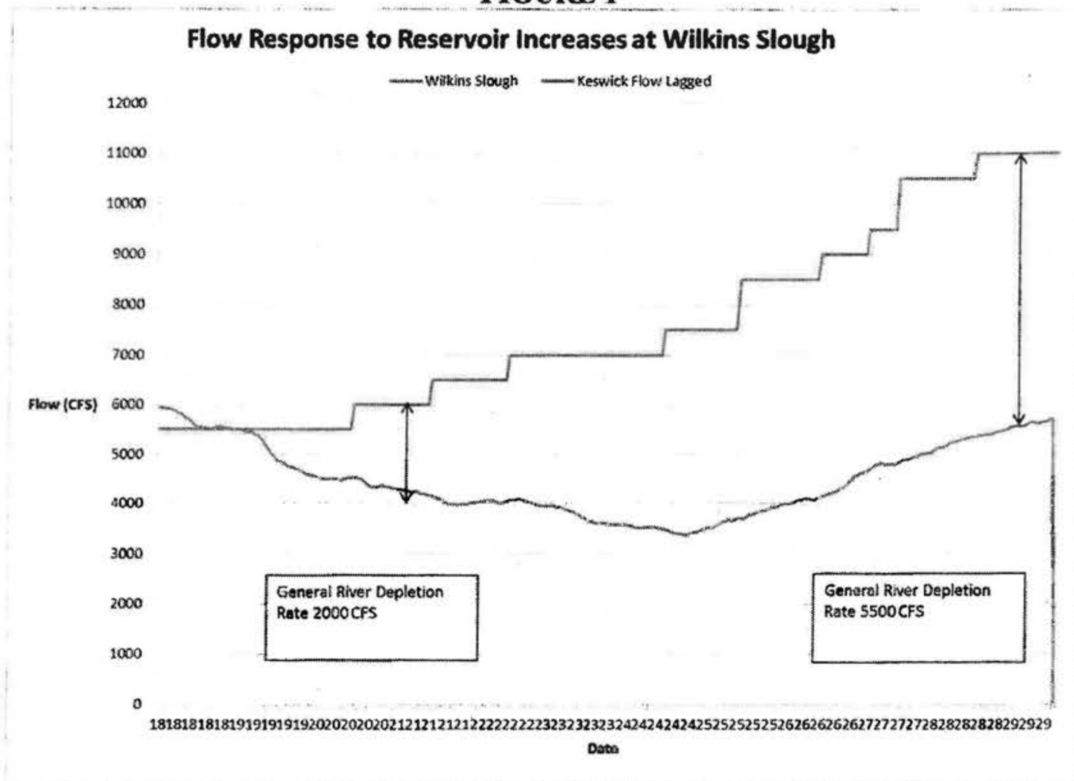
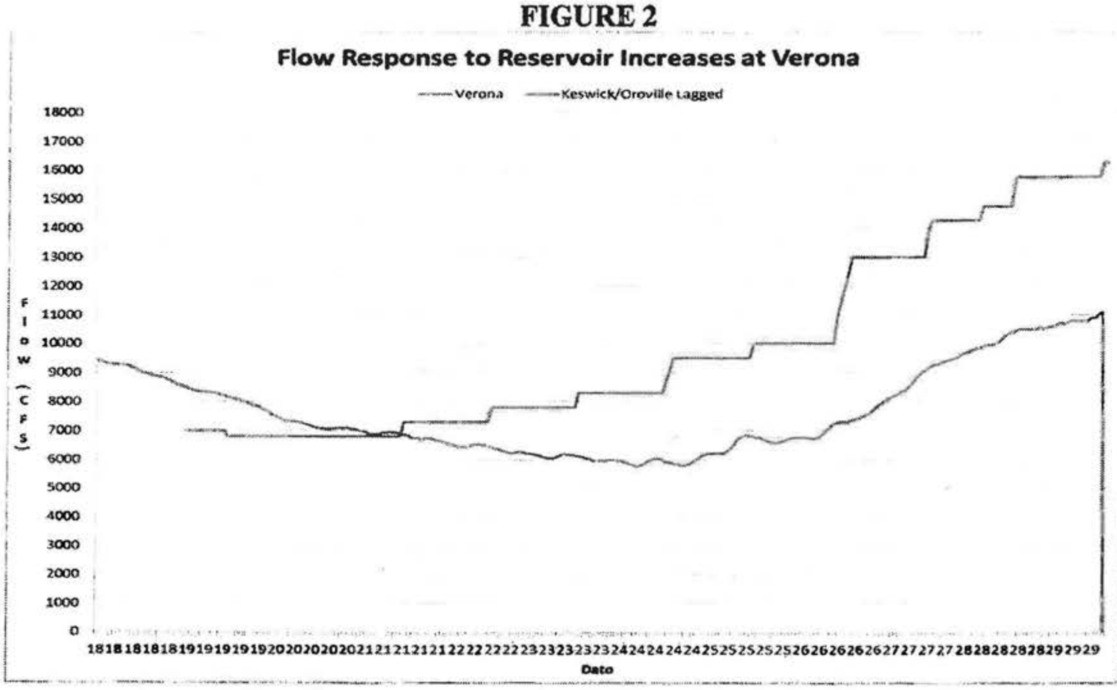
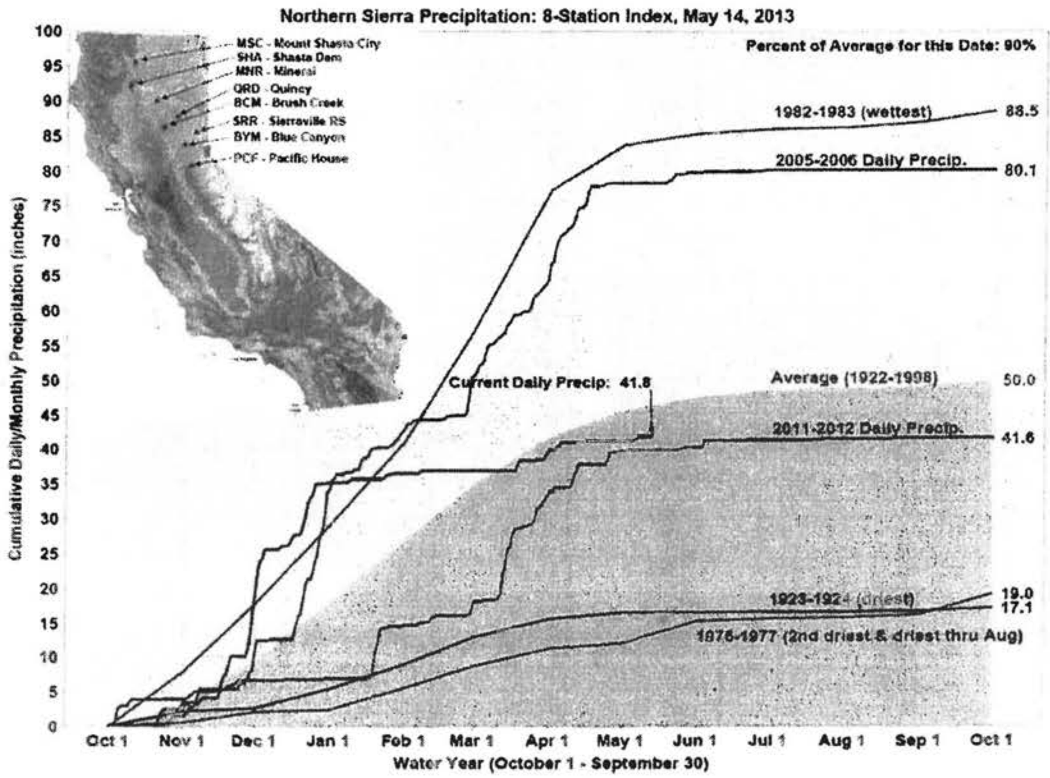


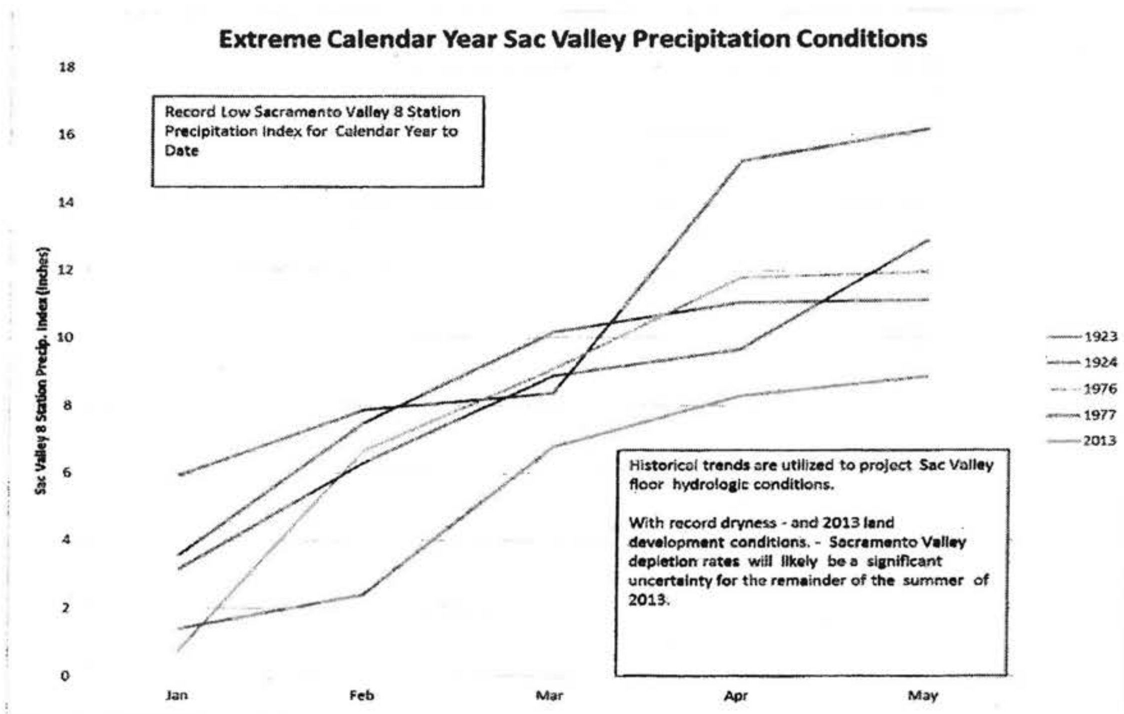
FIGURE 2



8SRI PLOT



Northern Sierra Precipitation: 8-Station Index, May 14, 2013
Percent of Average for this Date: 90%
MSC - Mount Shasta City
SHA - Shasta Dam
MNR - Mineral
QRD - Quincy
BCM - Brush Creek
SRR - Sierraville RS
BYM - Blue Canyon
PCF - Pacific House
1982-1983 (wettest) 88.5
2005-2006 Daily Precip. 80.1
Current Daily Precip: 41.8
Average (1922-1998) 50.0
2011-2012 Daily Precip. 41.6
1923-1924 (driest) 19.0
17.1
1976-1977 (2nd driest & driest thru Aug)
Cumulative Daily/Monthly Precipitation (inches)
Total Water Year Precipitation
Water Year (October 1 - September 30)
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1



Extreme Calendar Year Sac Valley Precipitation Conditions
Record Low Sacramento Valley 8 Station Precipitation Index for Calendar Year to Date
Sac Valley 8 Station Precip. Index (inches)
1923
1924
1976
1977
2013
Historical trends are utilized to project Sac Valley floor hydrologic conditions.
With record dryness - and 2013 land development conditions. - Sacramento Valley depletion rates will likely be a significant uncertainty for the remainder of the summer of 2013.
Jan
Feb
Mar
Apr
May

Compliance Standards

for the Sacramento - San Joaquin Delta and Suisun Marsh
Sunday, May 19, 2013

Criteria	Standard	Status
Flow/Operational		
% of inflow diverted	35 %	11 %
Habitat Protection, X2 / Flow	1 days at Chipps Island	3 days
* 2days as carryover from April	31 days at Collinsville	19 days
Water Quality		
Days @ CCWD PP#1 w/ chlorides <= 150 mg/l	165 days	139 days
Export Areas for SWP, CVP, CCWD, et al	<= 250 mg/l Cl	42 mg/l
14dm EC at Emmaton	<= 0.45 mS/cm	0.44 mS/cm
14dm EC at Jersey Point	<= 0.45 mS/cm	0.34 mS/cm
Maximum 30 day running average of mean daily EC at:		
Vernalis	<=0.7 mS/cm	0.3 mS/cm
Brandt Bridge	<= 0.7 mS/cm	0.3 mS/cm
Old River Near Tracy	<=0.7 mS/cm	0.4 mS/cm
Old River Near Middle River	<=0.7 mS/cm	mS/cm

SUISUN MARSH:

Suisun Marsh Salinity Control Gates : 1 Open / 0 Closed / 2 Full Tide Open
Flashboard Status : In
Boat Lock Status : Open

California Hydrologic Conditions: (California Cooperative Snow Surveys Forecast, May 1, 2013)

Previous Month's Index (8RI for April.): 2.023 MAF
Water Year Type: Dry
Sacramento valley water year type index (40/30/30) @ 50%:5.8 MAF (Dry)
San Joaquin valley water year type index (60/20/20) @ 75%: 1.6 MAF (Critical)

Electrical Conductivity (EC) in milliSiemens per Centimeter.
Chlorides (Cl) in milligrams per liter
mht - mean high tides
md - mean daily
14 dm - fourteen day running mean
28 dm - twenty-eight day running mean
NR - No Record
NC - Average not computed due to insufficient data.
BR : Below Rating
e - estimated value

Montezuma Slough Gate Operation:
Number of gates operating at either Open, Closed, or Full Tide Open
Flashboard Status : In, Out, or Modified In
Boat Lock Status : Open or Closed

Coordinated Operation Agreement Delta Status:
c = excess Delta conditions
b = balanced Delta cond. w/ no storage withdrawal
s = balanced Delta cond. w/ storage withdrawal
Excess Delta conditions with restrictions:
f = fish concerns
r = E/I ratio concerns

* NDOI, Rio Vista & Vernalis Flows:
- Monthly average is progressive daily mean.
- 7 day average is progressive daily mean for the first six days of the month.

Delta Water Quality Conditions

Date	Antioch Tides High	Antioch Tides Half	Net Delta Outflow Index cfs	Martinez mdEC	Port Chicago mdEC	Port Chicago 14dm	Mallard mdEC	Chipps Island mdEC	Chipps Island 14dm	Collinsville mdEC	Collinsville 14dm
04/20/2013	4.93	3.50	8,211	18.80	11.88	7.15	4.52	3.99	1.64	1.65	0.55
04/21/2013	5.12	3.57	7,471	21.29	13.71	7.53	6.22	5.68	1.90	2.35	0.68
04/22/2013	5.33	3.66	7,059	22.73	15.38	8.08	6.75	6.22	2.20	3.03	0.85
04/23/2013	5.73	3.88	6,849	24.39	15.82	8.80	7.88	7.37	2.65	4.18	1.12
04/24/2013	6.07	4.19	6,605	25.78	18.18	9.65	9.84	9.43	3.23	5.31	1.47
04/25/2013	6.47	4.25	7,038	26.40	18.77	10.49	10.63	10.27	3.86	6.13	1.88
04/26/2013	6.32	4.08	7,896	25.52	17.32	11.21	9.19	8.74	4.38	5.33	2.22
04/27/2013	6.31	4.02	9,030	24.92	16.30	11.84	8.76	8.29	4.86	4.95	2.54
04/28/2013	6.36	4.08	10,396	24.58	15.35	12.44	8.30	7.81	5.31	4.66	2.84
04/29/2013	6.40	4.24	10,578	24.44	14.82	12.96	8.21	7.72	5.75	4.38	3.11
04/30/2013	6.24	4.15	10,798	23.98	13.59	13.56	7.92	7.42	6.21	4.37	3.40
05/01/2013	5.84	3.99	11,146	22.44	11.37	14.10	6.67	6.13	6.60	3.97	3.66
05/02/2013	5.30	3.75	11,614	21.84	12.15	14.52	6.15	5.61	6.93	2.99	3.85
05/03/2013	5.51	3.82	10,635	21.60	12.21	14.78	6.64	6.10	7.20	3.02	4.02
05/04/2013	6.13	4.17	9,908	22.78	12.84	14.84	7.67	7.16	7.42	3.97	4.19
05/05/2013	6.32	4.48	9,485	25.15	12.95	14.79	9.37	8.93	7.66	5.28	4.40
05/06/2013	6.15	4.19	9,388	24.14	11.38	14.50	8.18	7.69	7.76	4.51	4.50
05/07/2013	6.06	4.10	9,350	23.80	11.10	14.17	8.04	7.54	7.77	4.44	4.52
05/08/2013	6.01	4.07	9,129	24.07	10.98	13.65	8.21	7.71	7.65	4.37	4.46
05/09/2013	6.05	4.08	9,695	23.57	9.40	12.98	7.95	7.45	7.45	4.07	4.31
05/10/2013	6.06	4.08	10,994	22.85	8.69	12.37	7.50	6.98	7.32	3.91	4.21
05/11/2013	6.04	4.03	11,743	21.76	7.75	11.76	6.63	6.09	7.17	3.39	4.10
05/12/2013	5.98	4.06	11,861	20.78	7.95	11.23	6.40	5.87	7.03	3.28	4.00
05/13/2013	5.94	4.12	11,402	21.10	7.48	10.70	6.19	5.65	6.88	3.12	3.91
05/14/2013	5.80	4.16	11,153	21.37	6.97	10.23	6.22	5.68	6.76	2.89	3.80
05/15/2013	5.72	4.15	10,114	21.13	5.60	9.82	6.14	5.60	6.72	2.74	3.71
05/16/2013	5.26	4.02	9,550	21.54	2.97	9.16	5.75	5.21	6.69	2.87	3.70
05/17/2013	5.18	3.95	8,987	21.04	2.33	8.46	5.39	4.85	6.60	1.99	3.63
05/18/2013	5.07	3.63	9,399	18.61	2.09	7.69	4.55	4.02	6.38	1.69	3.47
05/19/2013	5.27	3.48	9,727	18.03	1.99	6.91	4.14	3.62	6.00	1.52	3.20

Antioch Tides measured in feet above mean sea level.
Net Delta Ouflow Index calculated from equation as specified in D-1641, revised June 1995.
Chipps Island EC calculated from measurements recorded at Mallard Slough.
Electrical Conductivity (EC) units: milliSiemens per Centimeter
md : mean daily
14dm : fourteen day running mean
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e - estimated value

Delta Water Quality Conditions

Date	Antioch		Jersey Point		Emmaton		Cache Slough	Good Year Slough	Sunrise Club	Volanti Slough	Beldon Landing	Collinsville
	mdEC	14mdEC	mdEC	14mdEC	mdEC	14mdEC	mdEC	mhtEC	mhtEC	mhtEC	mhtEC	mhtEC
04/20/2013	0.39	0.42	0.23	0.25	0.20	0.20	0.39	5.83	5.06	5.62	5.55	2.04
04/21/2013	0.61	0.42	0.24	0.25	0.22	0.20	0.40	5.92	5.40	6.19	5.60	3.56
04/22/2013	0.87	0.44	0.24	0.25	0.25	0.20	0.42	6.13	5.97	6.77	5.93	4.39
04/23/2013	1.16	0.49	0.25	0.25	0.29	0.21	0.42	6.94	7.31	8.39	7.40	5.37
04/24/2013	1.93	0.60	0.30	0.25	0.71	0.25	0.42	8.71	8.59	10.03	9.00	6.92
04/25/2013	2.36	0.74	0.36	0.26	1.28	0.32	0.43	9.73	8.79	10.32	9.24	7.42
04/26/2013	1.91	0.85	0.33	0.26	1.06	0.39	0.43	10.74	9.36	10.77	9.23	6.54
04/27/2013	1.87	0.95	0.34	0.27	1.00	0.44	0.42	11.60	9.71	11.16	9.59	5.86
04/28/2013	1.93	1.06	0.35	0.27	0.89	0.49	0.43	11.74	9.83	10.73	10.02	5.61
04/29/2013	2.04	1.17	0.36	0.28	0.75	0.53	0.45	11.84	10.00	11.33	10.34	5.73
04/30/2013	1.90	1.28	0.37	0.29	0.64	0.56	0.46	11.91	9.92	11.63	10.50	5.40
05/01/2013	1.33	1.35	0.35	0.30	0.35	0.57	0.51	11.90	9.76	11.44	10.86	4.69
05/02/2013	1.28	1.42	0.32	0.31	0.35	0.58	0.46	11.85	9.95	11.16	10.66	3.85
05/03/2013	1.29	1.49	0.33	0.31	0.38	0.60	0.46	11.87	9.85	11.30	9.99	4.36
05/04/2013	1.55	1.57	0.36	0.32	0.44	0.61	0.48	11.74	10.13	10.74	9.79	5.88
05/05/2013	2.21	1.69	0.44	0.34	0.76	0.65	0.42	11.59	9.85	10.94	9.73	6.92
05/06/2013	1.87	1.76	0.39	0.35	0.67	0.68	0.42	11.57	9.68	10.58	8.64	5.54
05/07/2013	1.71	1.80	0.37	0.36	0.62	0.71	0.43	11.61	9.25	9.83	7.57	5.72
05/08/2013	1.66	1.78	0.36	0.36	0.63	0.70	0.45	11.64	8.67	9.42	7.11	5.77
05/09/2013	1.63	1.73	0.36	0.36	0.61	0.65	0.48	11.79	8.13	9.21	6.63	5.27
05/10/2013	1.48	1.70	0.35	0.36	0.57	0.62	0.50	11.99	7.76	8.60	6.49	5.24
05/11/2013	1.32	1.66	0.34	0.36	0.46	0.58	0.48	12.11	7.49	8.22	6.05	4.24
05/12/2013	1.32	1.61	0.34	0.36	0.41	0.54	0.45	11.82	7.10	7.63	5.50	4.49
05/13/2013	1.18	1.55	0.34	0.36	0.37	0.52	0.45	11.36	6.59	7.07	4.94	3.93
05/14/2013	1.12	1.50	0.34	0.36	0.34	0.50	0.43	11.33	6.13	6.45	4.24	4.30
05/15/2013	1.11	1.48	0.33	0.35	0.37	0.50	0.42	11.16	5.72	5.97	3.88	3.56
05/16/2013	1.03	1.46	0.32	0.35	0.32	0.50	0.40	10.60	5.18	5.67	3.68	
05/17/2013	0.91	1.44	0.31	0.35	0.29	0.49	NR	10.25	5.10	5.62	3.53	3.14
05/18/2013	0.74	1.38	0.30	0.35	0.25	0.48	NR	10.12	5.04	5.56	3.31	2.43
05/19/2013	0.70	1.27	0.29	0.34	0.23	0.44	NR	9.95	4.98	5.51	2.97	2.33

Electrical Conductivity (EC) units: milliSiemens per Centimeter
Chloride (Cl) units: milligrams per liter
mht : mean high tides
md : mean daily
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e : estimated value

Delta Water Quality Conditions

Date	Bethel Island mdEC	Farrar Park mdEC	Holland Tract mdEC	Bacon Island mdEC	Contra Costa mdEC	Clifton Court mdEC	Tracy Pumping Plant mdEC	Antioch mdCl	Bacon Island mdCl	Contra Costa mdCl	Delta Status
04/20/2013	0.25	0.29	0.26	0.27	0.34	0.57	0.75	54	33	37	f
04/21/2013	0.25	0.29	0.25	0.27	0.32	0.51	0.68	124	32	38	f
04/22/2013	0.24	0.29	0.25	0.27	0.33	0.46	0.60	206	32	37	f
04/23/2013	0.24	0.29	0.25	0.27	0.33	0.43	0.50	298	31	37	f
04/24/2013	0.25	0.28	0.25	0.27	0.32	0.40	0.49	545	31	37	f
04/25/2013	0.26	0.27	0.25	0.26	0.32	0.38	0.42	683	31	36	s
04/26/2013	0.26	0.29	0.26	0.27	0.31	0.35	0.43	537	32	36	s
04/27/2013	0.25	0.29	0.26	0.28	0.32	0.32	0.40	524	34	36	s
04/28/2013	0.26	0.29	0.26	0.28	0.32	0.32	0.35	544	35	36	s
04/29/2013	0.26	0.30	0.26	0.28	0.29	0.31	0.32	581	35	36	s
04/30/2013	0.26	0.30	0.26	0.28	0.31	0.34	0.33	535	34	36	s
05/01/2013	0.27	0.29	0.26	0.27	0.30	0.32	0.33	352	32	36	s
05/02/2013	0.28	0.29	0.21	0.27	0.31	0.33	0.32	337	32	34	s
05/03/2013	0.28	0.29	0.23	0.27	0.31	0.33	0.31	341	32	35	s
05/04/2013	0.28	0.30	0.27	0.27	0.30	0.32	0.31	424	32	35 e	s
05/05/2013	0.29	0.31	0.28	0.28	0.29	0.30	0.28	635	34	35 e	s
05/06/2013	0.29	0.31	0.28	0.28	0.29	0.25	0.28	525	35	33	s
05/07/2013	0.29	0.32	0.28	0.29	0.29	0.24	NR	475	37	33	s
05/08/2013	0.30	0.33	0.29	0.29	0.28	0.24	NR	458	38	33	s
05/09/2013	0.30	0.33	0.29	0.30	0.30	0.25	NR	448	40	34	s
05/10/2013	0.31	0.34	0.30	0.30	0.30	0.26	NR	400	41	35	s
05/11/2013	0.31	0.33	0.30	0.31	0.29	0.28	NR	351	42	35 e	s
05/12/2013	0.31	0.34	0.30	0.31	0.31	0.29	NR	351	43	35 e	s
05/13/2013	0.31	0.33	0.31	0.32	0.32	0.31	NR	307	44	37	s
05/14/2013	0.31	0.33	0.31	0.32	0.32	0.30	NR	288	45	39	s
05/15/2013	0.31	0.34	0.31	0.32	0.32	0.32	NR	283	45	36	s
05/16/2013	0.31	0.34	0.31	0.32	NR	0.34	NR	257	45	40	s
05/17/2013	0.31	0.34	0.31	0.32	NR	0.35	NR	220	46	42	s
05/18/2013	0.31	0.34	0.31	0.33	NR	0.36	NR	166	47	42 e	s
05/19/2013	0.31	0.34	0.31	0.33	NR	0.39	NR	151	47	42 e	s

Electrical Conductivity (EC) units: milliSiemens per Centimeter
Chloride (Cl) units: milligrams per liter
md : mean daily
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e : estimated value
Antioch and Bacon Island mdCl are calculated from the respective mdEC values.

Coordinated Operation Agreement Delta Status:
c = excess Delta conditions
b = balanced Delta cond. w/ no storage withdrawal
s = balanced Delta cond. w/ storage withdrawal
Excess Delta conditions with restrictions:
f = fish concerns
r = E/I ratio concerns

Delta Water Quality Conditions

South Delta Stations

Date	Vernalis		Brandt Bridge		Old River Near Tracy		Old River Near Middle River	
	md EC	30 day avg	md EC	30 day avg	md EC	30 day avg	md EC	30 day avg
04/20/2013	0.39	0.79	0.52	0.88	0.90	1.10	0.40	0.87
04/21/2013	0.30	0.77	0.41	0.86	0.76	1.09	0.43	0.85
04/22/2013	0.30	0.75	0.42	0.84	0.64	1.08	0.33	0.84
04/23/2013	0.27	0.72	0.32	0.82	0.62	1.07	0.31	0.81
04/24/2013	0.25	0.70	0.30	0.80	0.47	1.05	0.26	0.79
04/25/2013	0.24	0.68	0.24	0.78	0.41	1.02	0.22	0.77
04/26/2013	0.24	0.65	0.22	0.76	0.34	1.00	0.21	0.74
04/27/2013	0.23	0.62	0.21	0.73	0.38	0.97	0.21	0.72
04/28/2013	0.23	0.60	0.21	0.71	0.38	0.94	0.21	0.69
04/29/2013	0.22	0.58	0.21	0.68	0.37	0.91	0.20	0.66
04/30/2013	0.22	0.56	0.20	0.66	0.35	0.88	0.20	0.64
05/01/2013	0.21	0.54	0.20	0.64	0.32	0.85	0.20	0.61
05/02/2013	0.21	0.52	0.20	0.61	0.36	0.82	0.19	0.59
05/03/2013	0.20	0.50	0.20	0.59	0.36	0.80	0.20	0.57
05/04/2013	0.19	0.47	0.19	0.57	0.31	0.77	0.18	0.55
05/05/2013	0.18	0.45	0.18	0.55	0.27	0.74	0.17	0.52
05/06/2013	0.19	0.43	0.17	0.52	0.25	0.72	0.17	0.50
05/07/2013	0.20	0.41	0.18	0.50	0.28	0.69	0.18	0.48
05/08/2013	0.20	0.39	0.20	0.48	0.31	0.67	0.20	0.45
05/09/2013	0.22	0.37	0.20	0.45	0.30	0.64	0.21	0.43
05/10/2013	0.22	0.35	0.22	0.43	0.29	0.62	NR	NC
05/11/2013	0.21	0.33	0.23	0.41	0.29	0.59	NR	NC
05/12/2013	0.21	0.31	0.22	0.38	0.29	0.56	NR	NC
05/13/2013	0.22	0.29	0.22	0.36	0.30	0.53	0.23	NC
05/14/2013	0.26	0.28	0.24	0.34	0.30	0.50	0.25	NC
05/15/2013	0.33	0.27	0.27	0.32	0.31	0.48	0.29	NC
05/16/2013	0.38	0.26	0.32	0.30	0.36	0.45	0.37	NC
05/17/2013	0.40	0.26	0.37	0.28	0.43	0.43	0.44	NC
05/18/2013	0.44	0.26	0.44	0.27	0.47	0.42	0.47	NC
05/19/2013	0.48	0.26	0.47	0.27	0.54	0.40	0.51	NC

Electrical Conductivity (EC) units: milliSiemens per Centimeter
md : mean daily
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State of California - Department of Water Resources - Division of Operations & Maintenance - Operations Control Office

Delta Hydrology Conditions

Date	Sacramento River at Freeport + SRWTP cfs	Yolo Bypass cfs	East Side Streams cfs	San Joaquin River at Vernalis cfs	Rainfall inches	Clifton Court Forebay Intake cfs	Tracy Pumping Plant cfs	CCWD Pumping Plants cfs	Barker Slough Pumping Plant cfs	BBID Diversion cfs
4/20/2013	8,441	395	591	2,334	0.00	1,193	807	25	56	0
4/21/2013	7,858	398	548	2,545	0.00	1,494	810	25	62	0
4/22/2013	7,645 e	410	519	2,678	0.00	1,694	810	25	62	200
4/23/2013	7,194	439	529	2,935	0.00	1,690	813	25	48	73
4/24/2013	6,360	496	559	3,414	0.00	1,695	821	26	72	72
4/25/2013	7,006	530	570	3,582	0.00	996	817	25	70	67
4/26/2013	8,078	529	542	3,675	0.00	991	815	25	65	53
4/27/2013	9,423	585	502	3,765	0.00	995	814	24	78	66
4/28/2013	10,870	584	509	3,893	0.00	963	815	24	77	0
4/29/2013	11,478	602	512	4,130	0.00	2,421	815	26	83	66
4/30/2013	12,147	616	500	4,064	0.00	2,998	817	27	83	0
5/1/2013	12,415	623	479	3,954	0.00	3,193	814	152	88	66
5/2/2013	11,495	629	463	3,952	0.00	494	3,155	178	94	63
5/3/2013	10,056	623	466	4,043	0.00	494	3,082	226	117	67
5/4/2013	9,028	660	478	4,176	0.00	1,492	1,353	240	96	0
5/5/2013	8,414	665	456	4,105	0.00	1,490	937	245	84	0
5/6/2013	8,445	648	445	3,970	0.00	993	982	245	91	159
5/7/2013	8,390	616	456	3,838	0.00	793	980	243	84	91
5/8/2013	9,212	557	479	3,689	0.00	792	979	243	84	77
5/9/2013	10,884	510	484	3,581	0.00	793	978	257	84	70
5/10/2013	11,824	486	468	3,549	0.00	999	978	261	98	72
5/11/2013	12,068	450	478	3,509	0.00	993	983	258	101	0
5/12/2013	11,480	448	479	3,439	0.00	993	982	260	109	0
5/13/2013	11,425	500	451	3,376	0.00	993	980	266	110	206
5/14/2013	10,886	553	416	2,828	0.00	993	980	252	99	76
5/15/2013	10,928	603	400	2,090	0.00	992	979	236	97	86
5/16/2013	10,499	579	410	1,678	0.00	993	863	207	92	84
5/17/2013	11,073	605	445	1,521	0.00	688	811	190	103	65
5/18/2013	11,534	643	439	1,423	0.00	689	808	185	112	0
5/19/2013	11,854	618	418	1,309	0.00	699	808	202	103	0

SRWTP : Sacramento Regional Water Treatment Plant effluent.
Yolo Bypass : combined measurements of Cache Creek at Rumsey and Freemont Weir.
East Side Streams : combined stream flows of Cosumnes River at Michigan Bar, Mokelumne River at Woodbridge, miscellaneous streams estimated from Dry Creek at Galt (discontinued since Dec. 1997), and Calaveras River based on releases from New Hogan Dam.
Rainfall : incremental daily precipitation measured at Stockton Fire Station #4.
CCWD Pumping Plants : combined pumping at the Old River, Rock Slough and Middle River Plants.

Delta Hydrology Conditions

Date	Banks Pumping Plant cfs	Delta Gross Channel Depletions cfs	Rio Vista Flow cfs	QWEST cfs	Net Delta Outflow Index cfs	Percent of Inflow Diverted 3 day	Percent of Inflow Diverted 14 day	Delta Status
4/20/2013	1,161	1,900	7,029	1,372	8,211	13.3%	10.4%	f
4/21/2013	1,504	1,900	6,352	1,313	7,471	16.4%	12.6%	f
4/22/2013	1,504	1,900	5,850	1,404	7,059	18.7%	14.2%	f
4/23/2013	1,779	1,900	5,677	1,353	6,849	20.5%	15.7%	f
4/24/2013	1,504	1,950	5,301	1,512	6,605	21.3%	16.7%	f
4/25/2013	810	1,950	4,635	2,609	7,038	20.0%	16.0%	s
4/26/2013	895	1,950	5,229	2,868	7,896	17.7%	14.8%	s
4/27/2013	887	1,950	6,158	3,087	9,030	14.8%	13.4%	s
4/28/2013	985	2,000	7,366	3,247	10,396	13.6%	13.7%	s
4/29/2013	1,684	2,000	8,619	2,181	10,578	15.6%	17.3%	s
4/30/2013	2,348	2,000	9,164	1,856	10,798	18.7%	22.5%	s
5/1/2013	3,279	2,000	9,758	1,616	11,146	21.9%	27.7%	s
5/2/2013	1,123	2,000	9,998	1,850	11,614	22.0%	28.2%	s
5/3/2013	1,034	2,050	9,192	1,704	10,635	21.5%	26.9%	s
5/4/2013	1,654	2,100	7,925	2,226	9,908	20.2%	23.9%	s
5/5/2013	2,095	2,100	7,070	2,646	9,485	19.1%	20.8%	s
5/6/2013	596	2,100	6,543	3,083	9,388	16.4%	16.6%	s
5/7/2013	0	2,150	6,539	3,045	9,350	14.3%	13.7%	s
5/8/2013	0	2,150	6,459	2,905	9,129	12.8%	11.9%	s
5/9/2013	138	2,200	7,099	2,835	9,695	12.5%	11.5%	s
5/10/2013	1,101	2,200	8,501	2,745	10,994	12.4%	11.8%	s
5/11/2013	1,101	2,250	9,278	2,723	11,743	12.2%	12.2%	s
5/12/2013	1,101	2,300	9,440	2,691	11,861	12.1%	12.6%	s
5/13/2013	1,101	2,300	8,928	2,746	11,402	11.7%	12.3%	s
5/14/2013	1,015	2,350	8,918	2,498	11,153	11.7%	12.2%	s
5/15/2013	1,101	2,350	8,504	1,872	10,114	12.0%	12.2%	s
5/16/2013	930	2,400	8,577	1,233	9,550	12.5%	12.4%	s
5/17/2013	732	2,450	8,167	1,095	8,987	12.2%	11.6%	s
5/18/2013	732	2,450	8,690	992	9,399	11.5%	10.8%	s
5/19/2013	732	2,500	9,114	892	9,727	10.9%	10.2%	s

Delta Gross Channel Depletions from Dayflow Table 3.
Rio Vista Flow calculated from Dayflow equation.
QWEST calculated from Dayflow equation.
Net Delta Ouflow Index calculated from equation as specified in D-1641, revised June 1995.

Coordinated Operation Agreement Delta Status:
- c = excess Delta conditions
- b = balanced Delta cond. w/ no storage withdrawal
- s = balanced Delta cond. w/ storage withdrawal
- Excess Delta conditions with restrictions:
  - f = fish concerns
  - r = E/I ratio concerns

- Pg 2-31, 2.3.2.5, – East Bay MUD and Contra Costa WD should have been lead agencies as this EIS/R document will inform them for their decision on if to approve this document and to participate in the water transfer program. 96
- Pg 2-31, 2.3.2.5, – "Transfers to East Bay MUD and Contra Costa WD are limited by available pumping capacity at the Freeport intake and Contra Costa WD's Delta intakes..." Water diverted at Freeport does not traverse the delta and does not contribute to south delta water quality or net delta outflows. 97
- Pg 2-34, 2.3.2.7, – "Buyers and sellers may negotiate transfers that last one year or multiple years." The project could result in some land being idled for 10 years straight. This could lead to land use designation changes fostering development or protected habitat. The possible long term impacts should be further analyzed. 98
- Pg 2-39, 2.5, – "While the alternatives would affect different resources in different ways, none of the alternatives are considered to be the environmentally superior alternative. There are no unavoidable significant impacts associated with the Proposed Action that would otherwise be avoided or substantially reduced by an alternative, and each of the alternatives has its own unique set of environmental impacts which, on balance, would be a "trade-off" of environmental impacts in selecting any one alternative over another." A number of significant impacts have been ignored and missed by the EIS/R analysis. the Proposed Action (Alternative 2) is not the environmentally superior alternative. 2.5, provides "Alternative 4 would reduce effects to groundwater levels, quality, and land subsidence." Any land subsidence from groundwater substitution is a significant impact. Alternative 2 includes groundwater substitution and land subsidence impacts, so alternative 4 is clearly environmentally superior. 99
- Pg 2-39, 2.5 – The project should have separated crop idling from crop switching in an alternative as they have very different impacts and operational requirements. Crop switch was proposed and screened as a separate conservation measure from crop idling. If crop switching were made a standalone alternative along with other conservation measures such as irrigation canal lining and leak repair, irrigation system water distribution uniformity and water efficiency improvements and irrigation scheduling water use efficiency improvements, there would have been an alternative which yielded real water for transfer, was flexible and immediate to implement. This combination of measures in an alternative would have yielded substantial water supplies with fewer environmental impacts of the other alternatives. 100
- Pg 2-40, Table 2-9, 3.2 – "Cropland idling transfers could result in increased deposition of sediment on water bodies." Some soils carry contaminants with them. This sediment deposition degrades water quality and beneficial uses. Any degradation of beneficial uses is 101

significant for compliance with the Central Valley Regional Water Quality Control Board Basin 101
Plan.

- Pg 2-40, Table 2-9, 3.2 – "Cropland idling/shifting transfers could change the water quality
  constituents associated with leaching and runoff." The EIS/R consistently lumps the description
  of effects of these two very different actions together. These are separate, mutually exclusive
  actions to implement on a piece of ground and they have very different impacts in type and 102
  magnitude. The EIS/R must separate the analysis of these two actions and disclose and mitigate
  their impacts separately. As an example, crop shifting would have very little erosional
  deposition in tributaries while crop idling may precipitate large and significant soil deposition
  and contamination to waterways.
- Pg 2-40, Table 2-9, 3.2 – "Cropland idling/shifting transfers could change the quantity of organic carbon in
  waterways." Again, the impacts of these two separate and different project actions have been 103
  lumped together to obscure the impacts of each – they are not the same.
- Pg 2-40, Table 2-9, 3.3 – "Groundwater substitution transfers could cause a reduction in
  groundwater levels in the Seller Service Area." and "Groundwater substitution transfers could
  cause subsidence in the Seller Service Area." Both were determined by the EIS/R to be a
  significant impact. The mitigation proposed by the EIS/R is to monitor the groundwater levels 104
  and subsidence. Monitoring something does not mitigate the impact of a project, only positive
  action like having a specific decision threshold for ceasing groundwater pumping activities
  would be a mitigation. There also needs to be a mitigation plan if groundwater levels do not
  recover or subsidence occurs even after cessation of groundwater pumping.
- Pg 2-45, Table 2-9, 3.9 – "Cropland idling water transfers could permanently or substantially decrease the
  amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland
  under the FMMP." The EIS/R identifies the alternative 4 impact as significant and alternative 2 as LTS.
  Although alternative 2 includes groundwater substitution, there is no description in the alternatives which 105
  prohibits just as much crop idling in alternative 2 as in alternative 4 so both impacts are significant. If
  alternative 4 results in 177,000 acres of land being fallowed and alternative 2, because it includes
  groundwater substitution idles only 100,000 acres, the impact of alternative 2 is still significant even though it
  is less than alternative 4.
- Pg 2-45, Table 2-9, 3.9 – "Cropland idling water transfers could convert agricultural lands under the
  Williamson Act and other land resource programs to an incompatible use." Ther is no support for the LTS
  impact call when 177,000 acres of crops could be idled and nothing in the project precludes the same land
  being idled for all 10 years of the program? 10 years of crop idling and using the property for non- 106
  agricultural purposes is in direct conflict with the requirements of the Williamson Act. As the Proposed
  Project and alternatives are defined, the maximum impact to Williamson Act lands is 177,000 acres of crop
  idling on the same land for 10 years. This is a significant impact that must be mitigated and disclosed.
- Pg B-8, B.4.3.1.2 - "Transfer Operations and Priorities TOM uses an assumed priority for
  transfer mechanisms used to make water available under Project alternatives." This
  assumption is a fundamental flaw in the analysis of the impacts of the project. The
  alternatives clearly say that the sellers can transfer up to a limit amount. The project does not
  define in what priority or sequence those different sources for water for transfer would be
  implemented under the project. Operational problems with reservoirs or differences in
  snowpack in different basins could alter the sequence of implementation of the water transfer 107
  sources. As an example, if alfalfa prices were to go to levels that were unprofitable, many
  growers would first offer to switch to another crop and sell that water to the program.
  Although there is some rationale provided for the assumption used, the project may very well
  not operate that way at all in reality. The project must not be approved for operations that
  deviate from the assumptions used in the project analysis of impacts, otherwise the project
  has been permitted for impacts that were never analyzed mitigated or disclosed.
- Pg B-8, B.4.3.1.2, p1 - "TOM simulates the four transfer mechanisms in the following order: 108

• Groundwater substitution – for alternatives that include this mechanism
• Reservoir release 108
• Conserved water
• Crop idling – for alternatives that include this mechanism"

The TOM assumptions do not include crop shifting so the model assumptions were incomplete and incorrect to reflect the actions that were included in the alternatives.

- Pg B-9, Figure B-4 – The project is only using a 33 year period of record for hydrologic conditions. This truncated hydrologic period skews the impact analysis and fails to use the 109 best available science of the readily available and industry standard utilized 83+ year period of record. The EIS/R must be revised using the best available science as NEPA and CEQA requires.
- Pg B-9, B.4.3.1.2, – "Groundwater substitution transfers from the Sacramento Valley have the potential to create changes in stream-aquifer interaction that affect other parts of the water delivery system." Each tributary reach has unique surface and groundwater interactions. The EIS/R fails to disclose what the modeling assumptions were for the geographic distribution of the estimated groundwater transfers. If the groundwater is drawn from primarily adjacent to a single or limited set of tributaries then the groundwater surface water interactions and 110 impacts would be more severe and focused. It appears the analysis assumed an even distribution of the estimated (with unsound rationale) amount of groundwater substitution across the whole north of Delta seller area. This error in modeling assumption causes the analysis to conclude much lower impacts that would occur within the range of operations the proposed project and alternatives.
- Pg B-11, B.4.3.1.2 – "Changes in Delta inflow affect the CVP and SWP differently based on system conditions at the time and COA accounting." This is why we said in an earlier comment that the COA being out of date was a problem for this project that had to be 111 addressed by updating the COA.
- Pg B-15, B.4.3.1.5, – "Annual volumes were assumed to be made available on a monthly pattern based on the ETAW of rice, the assumed crop to be idled." This is a flawed assumption which leads to underestimating the impacts of the proposed project and alternatives. Rice has the highest ETAW at 3.3AF per acre of any of the crops proposed for idling. This assumption is in conflict with the reality of the program which would have a mix of idled crops with different and lower ETAW water consumption rates. This flawed 112 analysis assumption will either lead to the project estimating that less number of acres will be fallowed to accomplish a given target amount of water for transfer or less water being made available for transfer with a given number of acres idled. Either way, the analysis assumption under-estimates the impacts of the project and the analysis must be revised and recirculated once this material analytical error is corrected.
- Pg B-16, B.4.3.1.5, p4 – "Crop idling transfers offer the least flexibility of all transfer mechanisms. The decision to enter into crop idling transfers is typically made in spring months when there is still considerable uncertainty in the water supply forecast and the ability to convey water through the Delta." This is not true. In most years when water transfers are most desired are in years after the first year of a Dry or Critically Dry water year. In those cases when reservoir storage is down, although the exact amount of water 113 allocation may not be announced until the spring, all of the buyers already know that they want to buy water. Each of the water transfer water sources suffer the same limitations on knowing the delta conditions ahead of time and their ability to convey water through the delta. This misperception on the part of the project in terms of the relative desirability of the water sources in the sequence in which water sources would be implemented in the project is

flawed. In order to be conservative in identifying the types and magnitude of impacts from the proposed project, the EIS/R should have analyzed the range of actions that it desired to be permitted, not an undefined, unjustified and flawed rationale for generally how the program may or may not be implemented. In order to correct these flawed assumptions and allow a full range of operations as proposed by the project, the analysis needs to do a sensitivity analysis of doing the maximum amount of each water transfer type and in combination with other types. Only then will the potential impacts of the project be disclosed and properly mitigated. 113

- Pg B-16, B.4.3.1.5, – "Crop idling transfers make water available on the fixed schedule illustrated in Figure B-10. Therefore, transfer water made available in May and June, a total of 37 percent of the annual volume, can be lost or not diverted..." Some rice is not planted until the first of June, so the potential transfer loss in those cases is only 22% rather than the 37% as claimed in the EIS/R. 114
- Pg B-17, B.4.3.1.6, – "Analysis of the baseline CalSim II simulation of CVP and SWP operations was performed to identify potential opportunities to store both groundwater substitution and crop idling transfer water made available from April through June in upstream CVP and SWP reservoirs." Again, the analysis did not include the assumption of water transfer volumes from crop switching. 115
- Pg B-17, B.4.3.1.7, – "TOM simulates shifts in timing of Project water movement at SWP facilities by adjusting baseline Oroville releases and Banks pumping from July through September of some years. Logic in TOM adjusts Oroville releases and Banks pumping to create a more regular monthly pattern of available export capacity." The EIS/R stated that only Reclamation facilities and water transfers would be covered under this document and that any SWP operations in conjunction with this project would be subject to prior DWR approval and a separate environmental document. This analytical assumption seems to belie that EIS/R statement as the modeling assumptions clearly are counting on SWP operations to facilitate the water transfers covered under this environmental document. The EIS/R modeling assumptions must remove the assumption that SWP operations will be altered to facilitate these CVP water transfer operations. 116
- Pg B-17, B.4.3.1.8.1, – "East Bay MUD diverts both CVP Project water and transfer water at the Freeport Regional Water Project on the Sacramento River near Freeport." The water transferred by East Bay MUD through the CVP facilities is covered by the OCAP BOs water transfer provisions. The Freeport Regional Water Project facility is not part of the SWP or CVP that is covered under the OCAP BOs and therefore the ESA species impacts of transferring water through these facilities is not covered by an incidental take permit and must seek ESA consultation prior to implementation. 117
- Pg B-18, B.4.3.1.8.2, p1 – "Contra Costa WD diverts water under existing water rights, a CVP water service contract, and transfer water from multiple points of diversion in the Delta." The CCWD facilities are not part of the SWP or CVP that is covered under the OCAP BOs and therefore the ESA species impacts of transferring water through these facilities is not covered by an incidental take permit and must seek ESA consultation prior to implementation. 118
- Pg B-18, B.4.3.1.8.2 (this was a document numbering error, it should have been B.4.3.1.8.3), p1 – "Transfer water purchased by SLDMWA is conveyed through available export capacity at Jones and Banks pumping plants. Transfers from the Sacramento River assume a 20 percent carriage water adjustment to maintain Delta salinity. Transfers from Merced ID that enter the Delta from the San Joaquin River assume a ten percent carriage water adjustment." The EIS/R must disclose the basis and justification for these carriage water assumptions. 119

Under some conditions, the carriage water requirements to maintain delta water quality 119
would have to be much higher, e.g. 30 or 40%.

- Pg B-18, B.4.3.1.8.2 (this was a document numbering error, it should have been B.4.3.1.8.3),
p2 – "Additionally, water made available by Merced ID can be conveyed directly to
SLDMWA member agencies through facilities that connect to Merced ID's internal
conveyance system and facilities that join the lower San Joaquin River and the DMC without 120
going through CVP/SWP export facilities." These facilities and operations are not covered
under the OCAP BO operations or water transfer assumptions so these operations must seek
separate ESA consultation with the fisheries agencies prior to implementation.
- Pg B-18, B.4.4 – The EIS/R must disclose its assumptions as to what projects they included
as reasonably foreseeable. If they are elsewhere in the document, the mention of these 121
assumptions should have included a reference as to what section that content could be found.
In general this EIS/R is very poor at making the document reader friendly.
- Pg B-20, B.6.1, – "…they would need to complete individual NEPA and Endangered Species
Act compliance for each transfer…" Buyers and sellers will need to complete ESA 122
consultations anyway as the OCAP BOs only cover SWP and CVP water transfer activity and
specifically exclude coverage of buyer and seller area impacts.
- Pg B-20, B.6.2, – "Alternative 2 includes transfers under all potential transfer measures:
groundwater substitution, reservoir release, conserved water, and crop idling." Again, the
assumptions leave out crop switching which has very different modeling implications to
water use, savings and conveyance than crop idling. The current EIS/R modeling 123
assumptions do not reflect all of the actions included in alternative 2 and the analysis must
either be redone with the corrected assumptions or the description of and actions included in
alternative 2 must drop crop switching as a component.
- Pg B-23, Figure B-14 and Pg B-28, B-24 - The EIS/R stated that only Reclamation facilities
and water transfers would be covered under this document and that any SWP operations in
conjunction with this project would be subject to prior DWR approval and a separate
environmental document. This analytical assumption seems to belie that EIS/R statement as 124
the modeling assumptions clearly are counting on SWP operations to facilitate the water
transfers covered under this environmental document. The EIS/R modeling assumptions
must remove the assumption that SWP operations will be altered to facilitate these CVP
water transfer operations.
- Pg B-29, Figure B-27 – This figure demonstrates the point regarding project impacts on
proportional flows at tributary confluences on salmonid homing and straying. The 125
information to conduct the analysis of project impacts on straying is clearly available and yet
the EIS/R did not conduct that analysis, disclose the impacts or mitigate the impacts.
- Pg B-66, Appendix B, attachment 1 – The 2005 level of development should not have been
used in that the rest of the modeling updates were current up to January 2014. This out of 126
date level of development assumption biased the analysis results as the 2014 level of demand
is higher than it was in 2005.
- Pg B-66, Appendix B, attachment 1 – The Baseline Assumptions did not include
implementation of the existing OCAP BO RPA requirements for restoration of subtidal and
intertidal habitat and floodplain habitat. The subtidal and intertidal habitats have tidal
exchange impacts to delta water quality and CVP/SWP operations that must be included in
the modeling assumptions. These are reasonably foreseeable as they are current legal 127
obligations of the CVP and SWP that are required to be implemented prior to 2015. Since
the implementation deadline is so close, the location, design and operational characteristics
must be thoroughly defined by now or DWR and Reclamation will not be compliant with the

BO requirements. The floodplain habitat restoration results in altered water quality and water consumption from evapotranspiration and changes in the tidal prism that must be accounted for in the modeling and impact analysis. The modeling assumptions must be revised and the analysis rerun to reflect these current legal obligations of the CVP and SWP under the OCAP BOs. 127

- Table C-17, p1 – "Although D-1641 specifies 14-day durations for mean daily chloride concentration, since most DSM2 boundary conditions are specified as monthly values, it is not sensible to account for this constraint herein." DSM2 reports data on 15 minute time increments, so the data from DSM2 is readily available to do the analysis to determine the frequency, duration and magnitude of exceedances of this water quality parameter as defined and required by D-1641. The EIS/R must use the best available science and this readily available DSM2 data to complete this study. The failure to use the best available is unsupportable.. The quantity of data available from DSM2 is why this data is always presented as exceedance graphs to show the frequency, duration and magnitude of water quality exceedances. Monthly averages of this data mean nothing and are obviously designed by the project to obscure the impacts of the project. The EIS/R must be revised to include exceedance plots of the full time series of data that is available from DSM2. This comment applies to all water quality evaluations done from DSM2 data. 128
- C.9 – p2 – "1. the daily minimum stage was calculated for all the Base and three Alternative from the 15-minute model output ; 2. daily change from Base stage was calculated (Daily Alternative Min Stage – Daily Base Min Stage) 3. monthly average stage was calculated from the results at step 2." So the analysis took two daily time step data sources and decided to water it down to a nice monthly average that is designed to hide all but extraordinary catastrophic impacts. Dewatering an ag intake does not have impacts on a monthly basis, it is an impact that occurs on a day by day basis. With the current analysis, the intakes could be dewatered by 6" for 20 of the 30 days of a month and then covered by 1' of water for the last 10 days and still show no impact. This analysis and any other used in the EIS/R that used daily source data and analyzed it at a monthly average for the impact assessment must be revised to reflect a best available science use of the full potential of the data sets for a daily impact analysis. 129
- C-48, p4 – The Proposed Project "…alternative sees the largest increases in EC when exports are the greatest, with Critical water years in July seeing the largest percent difference of 4.2% at the SWP location and 3.3 % at the CVP location." This is a very significant impact as the SWP and CVP are constantly in violation of these water quality parameters in Critical water years already. For the proposed project to make that violation worse by over 4% is a very significant impact that must be mitigated. 130
- D.3.6, p1 – "The distribution of aquifer properties across the Sacramento Valley is poorly understood. In certain areas with significant levels of groundwater production, the collection of aquifer test data and the measurement of historical groundwater-level trends in response to known groundwater production rates have provided valuable information on aquifer properties. However, in the majority of the valley, these data are not available." Yes, this may be true, but it also invalidates the use of modeling for predicting groundwater and surface water interactions. This model is not generally accepted for these types of analyses and its use for this kind of document and analysis in this geographic area is unprecedented. Peer review and supporting acceptable calibration is not apparent. 131
- Appendix D – The documentation fails to disclose the assumptions used in the model of how the groundwater substitution was geographically distributed or that the model used actual well locations that would be used under the Proposed Project and alternatives. Based on the 132

very generalized description of the data, we conclude that the model used an assumption of an average groundwater source usage distributed evenly across the seller areas. This assumption of course would have no relationship to reality or the impacts that would occur with implementing the project within the boundaries of how it was described. The generalized assumption of distributed groundwater well locations and demand would vastly underestimate the localized groundwater and surface water interaction impacts from the project that would be implemented such that those impacts were not uniformly distributed. The groundwater analysis in the EIS/R must be redone using an accepted model, with specific well locations and water demands. 132

- Figure D-4 – There are almost no well data points to characterize the hydraulic conductivity of the aquifer in the Feather River basin in which many seller areas were identified. These areas have almost no data to support the model analysis which render the results unreliable. 133

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Baseline Definitions

- The EIS/R No Action/Project assumptions were not consistent with the BDCP EIR/S and Reclamation Remand EIS. Since Reclamation is a lead agency for all of these projects and they are all on the CVP operations and they all occur over the same time period, it is an inexcusable inconsistency and bias in the outcomes of the analysis to have different baseline assumptions. Since the other documents have undergone public review already, this project's No Action/No Project assumptions must be revised to be consistent with these other documents, reanalyzed and revised, and then recirculated for public comment. 134

Impact Analysis Geographic Scope

- The geographic area included in the EIS/R impact assessment fails to include areas and tributaries downstream of drainage from water transfer recipient service areas. Transferred water will be applied to buyer areas and some of that water will result in runoff that will be carried downstream of those service areas. Those water transfer runoffs will alter flows and water quality in those downstream tributaries. Some of those downstream tributaries that should have been included in the EIS/R analysis, but were not, include (but are not limited to): San Joaquin River, Coyote Creek, Liaghs Creek, Pescadero Creek, Uva Creek, Stevens Creek, Beryessa Creek, Alameda Creek, Tassajara Creek, Walnut Creek, Marsh Creek, Kellog Creek, Lone Tree Creek, Hospital Creek, Corral Hallow Creek, Ingram Creek, Salido Creek, Crow Creek, Orestimba Creek, Garzas Creek, Quinto Creek, Romero Creek, Los Banos Creek and others. The San Joaquin River and several of these creeks are documented habitat for ESA species salmonids and therefore the lack of analysis of these ESA species impacts in the EIS/R is a particularly egregious omission. 135
- The geographic area included in the EIS/R impact assessment fails to include areas from the reservoirs involved in the project to the upstream first impassable fish barrier. Fluctuations of the reservoirs from project releases affect the ability for reservoir fish to forage and 136

spawn in the upstream tributaries. The project operations reduce reservoir cold and warmwater fisheries access and use of these upstream habitats from exposing sediment wedges in the tributaries at the interface with the reservoir and increasing the frequency 136 and duration of impassable conditions for fish. Cold and warmwater fisheries are designated beneficial uses of water in the CV Basin Plan and therefore must be evaluated in a revised EIS/R.

- Both seller and buyer service areas are in unconfined groundwater basins. The impact area of groundwater resources, surface water interactions with groundwater, and fisheries and wildlife resources in the adjacent groundwater basins connected to these seller and buyer service areas must also be fully analyzed in the EIS/R. As the EIS/R stands, these extended 137 impact areas in the interconnected groundwater basins are not identified, characterized, evaluated, quantified, mitigated or disclosed. This serious omission in the extent of the geographic area of impact from the project must be corrected in the revised EIS/R.

Impact Analysis Significance Criteria

- The EIR must use a full range of significance criteria which are consistent with Reclamation's use in other similar environmental documents. These similar environmental documents from which Reclamation should use the significance criteria include: Remand EIS, Shasta Enlargement, Sacramento Valley Water Management Plan (AKA Phase 8), CALFED, and BDCP. For this project to use anything less than the synthesis of the significance criteria from these recent and similar 138 projects with Reclamation as the lead agency would be an inconsistent application of policy, procedure and science. The EIS/R impact analysis must be revised to address them missing impact criteria and thresholds. The revised EIS/R must be recirculated after addition of this material new information.

Permits Needed by the Project

- ESA Incidental Take Permit – Impacts from the selling and receiving water service areas are not covered by the OCAP BOs. They will require separate section 7 consultation (BA and BO). NMFS OCAP BO, pg729, p3 - "...this consultation does not address ESA section 7(a)(2) compliance for individual water supply contracts. Reclamation and DWR should consult with NMFS separately on their issuance of individual water supply contracts, including analysis of the effects of reduced water quality from agricultural and municipal return flows, 139 contaminants, pesticides, altered aquatic ecosystems leading to the proliferation of non-native introduced species (*i.e.*, warm-water species), or the facilities or activities of parties to agreements with the U.S. that recognize a previous vested water right." The water transfers ESA species impacts in the seller and buyer service areas are not covered under the FWS or NMFS OCAP BOs and therefore a separate section 7 or 10 consultation for the water transfers for the seller and buyer service areas must be conducted and approved prior to the water transfers.
- Reclamation and DWR have not implemented the OCAP BO RPAs, so the CVP and SWP are 140 not compliant with the terms of their current Incidental Take Permits (ITP). NMFS

specifically provides in the OCAP BO that if the agencies are not compliant with the terms of
the OCAP BO RPAs that they will rescind their ITP. Since DWR and Reclamation are not 140
compliant with the OCAP BO RPAs (see related comments), NMFS must rescind Reclamation
and DWRs ITP and reinitiate ESA re-consultation. FWS and NMFS cannot approve the
permits for the proposed water transfers until OCAP BO compliance is achieved.

- The project will require a 401 Clean Water Act certification to address all types of discharges
that occur under the proposed project and alternatives. These discharges by the project
which must be permitted include (but are not limited to): releases from each reservoir to
each tributary involved in the transfers, leaks from conveyance used in the water transfers
(e.g. California Aqueduct), discharge at the water transfer recipient service area, discharges 141
of water used in the buyer service areas, discharge groundwater pumped for groundwater
substitution, discharge of groundwater substituted water after use on the fields. These last
categories of discharges from groundwater wells and drainage discharge of groundwater
substituted fields represent new locations of discharges for the project that would not be
covered under any 401 permits the SWP or CVP currently have (if they have any).
- The project will also need Air Quality permits for project impacts from (but not limited to):
electrical load demand from groundwater pumping (this increased electrical load is not
offset by not surface water pumping), changes in the timing and location of electrical
generation from backing up water in reservoirs for transfer (the foregone generation must
be replaced and the timing of the impacts are different), idling crops causes wind erosion 142
and airborne particulate loads, operating equipment on fields receiving water from transfers
in the buyer service areas are emissions that would not happen under the No
Action/Project. All of these impacts are different from the conditions of the CVP and SWP
without the project so these impacts are not covered by any current CVP or SWP air quality
permits (if they have any).

Water Supply

- The EIS/R must be revised to evaluate the year to year potential geographic distribution of the
sellers and to evaluate the worst case scenario of the distribution (or lack thereof) of the sellers.
Since the EIS/R did not evaluate a worst case scenario for how the sales would be distributed,
the project must not be approved or permitted for operations that would result in more
geographically concentrated impacts than what was represented in the analytical assumptions
in the EIS/R. The EIS/R assumed an average water transfer contribution from all seller areas for
the available transfer capacity for each water year type. With these assumptions, the impacts
are equally spread and are reduced in severity in any geographic location the most of any of the 143
potential operational scenarios. The EIS/R should have conducted and disclosed some
sensitivity analysis in which the extremes of operational scenarios were tested and evaluated for
their environmental impacts. Several of these scenarios that represented the worst potential
impacts from the project should have been fully evaluated. Only under that approach could the
project be awarded permits that allow the full amount of water transfer proposed under a set of
mitigations that would have addressed the impacts. The analysis took the most optimistic (and
completely unrealistic) assumption of even geographic distribution water transfer operations
and impacts, each of the identified seller areas should be only allowed to transfer the averaged
amount of water that was actually analyzed in the EIS/R. Here is a description and analysis of

the critically flawed assumptions the impact analysis used in its impact analysis. The maximum proposed water transfer by the identified water sellers is 511,094AF. In all water years except Critical, Consecutive Dry, and Dry after Critical; the FWS OCAP BO says that the maximum transfer that can be conducted under the permitted conditions is 360,000AF. The EIS/R makes the erroneous assumption that the 360,000AF would be evenly distributed across the seller's area. In reality, the impacts would never be so perfectly distributed and reduced in their severity. The EIS/R should have tested a number of scenarios in which the transfer water was concentrated with various combinations of sellers. The EIS/R should have evaluated the 143
impacts of all of the transfers coming from a single drainage basin under these limited subscription conditions, e.g. all from the Feather River or American River basin and none from the Sacramento River/Shasta drainage basin or visa versa. The scenario of all water transfers from one basin and none from another basin is very plausible as snowpack could favor one basin over another and make more or less water available for transfer or operational considerations of reservoirs in one basin vs. the other could make water storage much more feasible. The EIS/R should have evaluated at least two scenarios of different distribution of willing sellers. These are: all available sellers from the Sacramento and Feather River Service area with none from any of the other seller service areas and another scenario of all transfers being from Merced River, Delta, American River, Yuba River, and Feather River with none from the Sacramento River.

- The EIS/R does not analyze the impacts of the proposed project and alternatives on other existing long-term (e.g. YCWA Lower Yuba River Accord) or year-to-year water transfer opportunities. The proposed project and alternatives preclude or significantly reduce the amount of potentially available excess CVP and SWP capacity for other long- and short-term water transfers which compete to use these same CVP and SWP facilities. Some of the Lower 144
Yuba River Accord water transfers are for environmental objectives. Some or all of these transfers may not occur under the proposed project or alternatives. This is unknown because the EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose the impacts to these other water transfers. This omission is a material deficiency of this EIS/R document which must be revised and recirculated.
- The EIS/R proposed "paper water accounting" as the basis for some of its analysis. As an example, the project description says that "These agencies... would use the water diverted from the San Joaquin River in exchange for their CVP water from the Delta-Mendota Canal." (EIS/R page 2-25, p3). The impacts of the other 4 proposed conveyance routes and operations are very 145
different from the foregone diversions of these other water districts in favor of the proposed San Joaquin River diversion impacts. The different impacts of these different proposed modes of accomplishing this Merced ID water transfer were not analyzed, mitigated or disclosed in the EIS/R. These material omissions and deficiencies in the EIS/R must be corrected in the revised and recirculated EIS/R.
- If the transferred water is allegedly conserved and does not result from and is limited to an actual reduction in consumptive use (which will vary with the climate) it could reduce runoff to 146
surface flow and percolation to recharge the groundwater.
- Is water transferred from outside of basin? E.g. Feather River basin surface water rights 147
transferred, but delivered from Shasta?
- Operational assumptions for reservoir storage for water transfer failed to take into account operational changes required by the OCAP BO RPAs for fish passage at Shasta, Folsom and New 148
Melones.

- The EIS/R analysis should be specific on the operations and impacts for each water transfer in order to justify project-level permits required for implementation of the project. The level of 149 specificity of the current EIS/R is only at a programmatic level of detail so the project should be subject to additional project level impact analysis prior to implementation each year.
- The EIS/R analysis should be specific on the operations and impacts for each water transfer and cumulatively for year to year for the project and in combination with all current and other 150 reasonably foreseeable projects, e.g. Lower Yuba River Accord water transfers.
- Each river, stream and location has different geology and hydrology. The EIS/R analysis did not incorporate analysis of all potential operational scenarios that could occur under the range of operations and conditions included in the project description. The project should only be 151 permitted for the operations and conditions analyzed, mitigated and disclosed in the EIS/R, not on the range proposed that were not addressed in the analysis.
- Water transfers from this project result in discouragement of investment in water conservation or adaptation of water users to more sustainable water uses in the Buyer Service areas. If you can buy water cheaper than the cost of implementing water conservation to achieve an equal amount of water supply then you will always choose the cheaper option of buying the water. This is also why desalination projects or other new water or major conservation efforts (e.g. fixing all the water conveyance leaks) will never occur until all the cheaper water that exists is 152 purchased and transferred. This project and others like it, result in a California that will continue to take water from each other until there is no more water to take before it makes any meaningful investment in water conservation, alternative water supplies, and changes in lifestyle related to water use (hundreds of golf courses in the desert) and water allocation. The BDCP does not count as a project to create new water as this project claims that it "won't divert any more water than current operations" and the real purpose of that project is to just facilitate the transfer of water from a poorer Northern California to a richer Southern California.
- CVP and SWP operations are often constrained by net delta outflow requirements. The Net Delta Outflow Index (NDOI) that the SWP and CVP are currently using is grossly over-reporting net delta outflow. "While the NDOI is, at best, an estimate of Delta outflow, there are stations that accurately measure actual Delta outflow. The United States Geological Survey (USGS) has established a series of stations in the Delta to measure flow and water quality parameters." "Four of the USGS gauging stations... accurately measure Net Delta Outflow (NDO)." ("*The Case of the Missing Delta Outflow*", California Sportfishing Protection Alliance) DWR's own analysis of NDOI ("Dayflow") estimates vs. the new more accurate USGS gage measurements indicates 153 that the "Dayflow under estimates flow during wet periods and over estimates flow during dry periods." (http://www.water.ca.gov/dayflow/docs/2013_Comments.pdf) This DWR report means that during the majority of the CVP and SWP diversion season (spring through fall), the operations systematically over estimate NDOI and systematically divert more water from the south delta than regulatory operational constraints would allow if NDO was correctly accounted for. As a result of this over-estimation of net delta outflows and the resulting lack of operational constraint, Reclamation and DWR's evaluation of available excess capacity for water transfers for this project will result in more capacity being identified as available as actually would exist if

the delta net outflows were being accurately measured. The EIS/R must include an evaluation of the accuracy of the Delta Net Outflow Index accuracy and an adjustment for the water transfer delivery quantities that would result from correctly adhering to the operational constraints of the CVP and SWP from Delta Net Outflow Index requirements. This regular exceedance of regulatory constraints on the CVP and SWP operations must be evaluated in this 153
EIS/R and water transfer amounts included in the project must be limited to amounts that would not result in the CVP and SWP violation of net delta outflow requirements. This over estimation of net delta outflow also results in insufficient carriage water being pulled out of the water transfers to maintain delta water quality and CVP/SWP operational compliance with the OCAP Biological Opinions and the Reclamation Remand court order.

- Coordinated CVP/SWP operations, funding and water deliveries are based on the COA. The COA is grossly out of date and has not been updated since 1986. COA determines the proportional distribution of available water supplies and operations. If the COA were updated, the amount 154
and locations of excess capacity in the SWP and CVP system would change. This project must include an update to the COA as part of the scope or the actual amount of conveyance capacity available for transfers cannot be determined.

Water Rights

- Water rights were not addressed at all in the ES impact summary table. 155
- In 2014, some federal water contractor's had stored some water from the previous year for later release at Reclamation's Friant facility. Due to the drought conditions and lack of available water supply in 2014, Reclamation decided to deliver that water contractor stored water to the Exchange Contractors to fulfill their other standing obligations to the Exchange Contractors rather than to the water agencies that stored their water in Friant. The EIS/R does not address this potential scenario in released water from reservoirs or the "backed up" water operations of the Proposed Project or alternatives. As a very similar scenario example for the Proposed Project or alternatives, water stored in Friant for Merced Irrigation District that was held back specifically for a water transfer could be hijacked by 156
Reclamation to service the Exchange Contractors instead. This scenario could easily occur on the other dams with backed up water released to fulfill minimum flow or senior water rights holders on the downstream tributaries rather than for the project water transfers. Again, there is a difference in the timing and location of impacts for when the water is released and where it is used for the project or for other obligations. Without the project, the backed up water would not have existed so there would not be the impacts of releasing that water to fulfill these other obligations. The difference in release timing and location of use create impacts that the EIS/R did not identify, characterize, evaluate, quantify, mitigate or disclose.
- When downstream senior water right holder settlement agreement (settlement contractors, e.g. Shasta - Tehama and GCID; Oroville – WCWD, BWGWD, Richvale, etc.) water supply is 157
released from storage for transfer to the water buyers under the Proposed Project and alternatives, it may include natural flow water or stored water which is in violation of permit

terms and conditions from their Settlement Agreements. The water rights that the settlement contractors have under the settlement agreement are not the same as their original pre-1914or riparian water right so they should not have the senior water right status for the water transfer. Since they do not have this senior water right status, these 157
actions must not be allowed to affect parties with more senior water rights. All water transfers must be subject to water rights priorities. The EIS/R is deficient as it did not correctly differentiate the water rights level of the settlement contractors and allowed these water transfers to impact the water rights (water quality) of more senior water rights holders.

- The analysis should cover the requirement or recognition that no water can be exported from the Delta by the projects unless the Delta is first provided an adequate supply (WC 12200 etseq.) and to the extent the transfer is dependent on the water rights of the SWP or 158
  CVP the water can be recaptured to serve needs in the watersheds of origin (WC 11460 etseq.).
- Reclamation and DWR water rights are subordinate to senior rights and conditioned on compliance with statutory requirements as well as permit conditions. The CVP and SWPs post-1914 water rights are junior to most in-Delta water rights and, as a result, the project has no right to divert the natural flows within the Delta if there is not enough natural flows through the Delta to satisfy in-Delta pre-1914 appropriative rights. The CVP and SWP, as 159
  junior water rights holders, are also not allowed to impair the water quality of the senior water rights holders from the operational impacts of their diversions. Reclamation and DWR, through their CVP and SWP operations, consistently violate these water quality standards and impact the beneficial uses of water for agricultural use of the senior water rights holders in the delta.
- The SWRCB cannot certify or issue permits on a project which knowingly and consistently violates state surface water rights and the addition of these water transfers under the Proposed Project and alternatives would only exacerbate the frequency, magnitude and duration of these violations. Area of Origin Statutes were enacted during the years when California's two largest water projects, the Central Valley Project and State Water Project, were being developed to protect local Northern California supplies from being depleted as a result of the projects. County of origin statutes provide for the reservation of water supplies for counties in which the water originates when, in the judgment of the State Water Resources Control Board, an application for the assignment or release from priority of State 160
  water right filings will deprive the county of water necessary for its present and future development. Watershed protection statutes are provisions which require that the construction and operation of elements of the Federal Central Valley Project and the State Water Project not deprive the watershed, or area where water originates, or immediately adjacent areas which can be conveniently supplied with water, of the prior right to water reasonably required to supply the present or future beneficial needs of the watershed area or any of its inhabitants or property owners. The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the area of origin conflicts.

- The Delta Protection Act, enacted in 1959 (not to be confused with the Delta Protection Act of 1992, which relates to land use), declares that the maintenance of an adequate water supply in the Delta--to maintain and expand agriculture, industry, urban, and recreational development in the Delta area and provide a common source of fresh water for export to areas of water deficiency--is necessary for the peace, health, safety, and welfare of the people of the State, subject to the County of Origin and Watershed Protection laws. The act requires the State Water Project and the federal CVP to provide an adequate water supply for water users in the Delta through salinity control or through substitute supplies in lieu of salinity control. The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the water supply conflicts addressed under the Act. 161
- In 1984, additional area of origin protections were enacted covering the Sacramento, Mokelumne, Calaveras, and San Joaquin rivers; the combined Truckee, Carson, and Walker rivers; and Mono Lake. The protections prohibit the export of ground water from the combined Sacramento River and Sacramento-San Joaquin Delta basins, unless the export is in compliance with local ground water plans. Also, Water Code Section 1245 holds municipalities liable for economic damages resulting from their diversion of water from a watershed." (http://www.waterplan.water.ca.gov/previous/b160-93/b160-93v1/ifrmwk.cfm) The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the water supply and groundwater conflicts addressed under the water code. 162
- Reclamation is not compliant with their junior water rights requirements as the CVP operations frequently exceed Delta water quality requirements in violation of the Delta Protection Act of 1959. Transfers of water supplies through the CVP or SWP from conjunctive use of groundwater substitution for surface water supplies are not consistent with local groundwater plans. Water contractors supplied through the SWP are liable for any direct or indirect damages from diverting water from a watershed. These damages may include injury, damage, destruction or decrease in value of any such property, business, trade, profession or occupation resulting from or caused by the taking of any such lands or waters, or by the taking, diverting or transporting of water from such watershed. (Water Code 1245) The addition of these water transfers under the Proposed Project and alternatives would only exacerbate the water quality impacts addressed under the Act. 163
- The Proposed Project and alternatives must consider the water supply, water rights, water quality impairments and other water beneficial use impacts associated with the water transfers of south delta water. The conditions of waters in the delta including direction of flows, water quality and impacts to agriculture, drinking water supplies and fisheries resources are a direct consequence of the CVP and SWP south delta facilities water diversions. 164

Water Quality

- The sellers identified are mostly water districts. When water districts transfer water they typically rotate the fallowed lands from year to year so not the same land or owners are participating from year to year. The EIS/R just assumes there will be some even distribution of the fallowed fields across a water district. They do put some constraints on adjacency to wildlife refuges, but other than that, the fallowing could occur in any location or in any combination of locations or concentrations. By not having specific locations or a very specific rule set about how fallowed fields can be distributed within a water district, the 165

analysis of the impacts from field fallowing is at a programmatic level of detail, not a project site specific level of detail. The rules for how fallowed fields are distributed in a water district are not specific enough to allow detailed analysis of impacts such as reduced ag drainage return flows and resulting drainage flows and water quality impacts. The EIS/R 165
must be revised such that project specific levels of detail on the impacts of field fallowing are conducted. Although the agencies can approve a programmatic EIS/R, this project, because of its lack of project-level analysis of impacts, must have a subsequent environmental analysis prior to implementation.

- Each groundwater basin and sub-basin area has different water quality, e.g. south of Sutter Buttes has higher saline groundwater than farther to the north. Different depth groundwater aquifers can have different water quality. The differences in groundwater quality that would be substituted for surface water supplies and the specific differences in 166
the water quality of discharge water from the conjunctive use properties in the project are not characterized, evaluated, quantified, mitigated or disclosed in the EIS/R. This material omission of groundwater substitution water quality impacts on surface and groundwater quality must be addressed in a revised and recirculated EIS/R.
- Ag drainage water quality is lower in the areas of groundwater substitution than if their surface water supplies were utilized. As an example of the impact of the project, groundwater is higher in dissolved minerals (TDS) than surface water. High dissolved minerals in water can have significant adverse impacts on development of juvenile 167
salmonids that occur in the tributary reaches where the proposed project surface water quality degradations would occur from groundwater substitutions. The Sacramento Valley Regional Water Plan (AKA Phase 8) identified and addressed those impacts in their project's conjunctive use analysis, but this project EIS/R did not even though Reclamation was a lead agency on both projects and both involve conjunctive use.
- The EIS/R also failed to evaluate the impact of fallowed fields on reduced ag return flow volumes and increased contaminant loads which could exceed the discharge permits tolerances, e.g. water temperature difference, TDS, DO, nutrient loading, DOC, ECw, 168
contaminant metals (Hg, Se, Pb, Fe) other (diaznon, DDT, chlorpyrifos, etc.) of the water and reclamation districts. This is a material omission and deficiency of the EIS/R which must be corrected in the revised EIS/R prior to recirculation.
- The Proposed Project and alternatives will result in water quality impacts to delta and other 169
beneficial uses which were not fully addressed in the EIS/R.
- The Proposed Project and alternatives idling of fields will result wind erosion of soils which will be deposited into tributaries which will degrade water quality of those tributaries with the associated contaminant loads. The contaminant loads from fallowed field wind and water erosion into surface water tributaries was not fully addressed in the EIS/R because the 170
location and number of fields was not defined by the Proposed Project and alternatives. This significant impact must be more specifically analyzed for the field locations, number and distribution and the significant impacts to surface water quality mitigated and disclosed.

- Water quality impacts vary greatly depending on the tributary and groundwater substituted, e.g. Berryessa and Putah Creek flow transfers would mobilize a disproportionate amount of Hg. Transfers from Friant to Westlands would mobilize a disproportionate amount of Se. Both of these project impacts are not fully addressed in the EIS/R. This significant impact must be more specifically analyzed for the tributary locations, timing of substitution and transfer, and volume of those transfers and the significant impacts to surface water quality for the project mitigated and disclosed. 171

Groundwater

- If the transferred water is based on an actual reduction in consumptive use (which will vary with the climate)' it will reduce runoff to surface flow and percolation to recharge the groundwater. As an example, ag irrigation quantities include a component for leaching salts below the plant root system. The leaching component of irrigation water contributes to groundwater recharge. In the case of proposed project idling of fields or crop switching to lower water use crops, that irrigation leaching component contribution to groundwater recharge is significantly reduced or eliminated all together. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose this significant impact from the Proposed Project and alternatives. This material omission in the analysis of the EIS/R must be rectified and submitted for public review in a recirculated document. 172
  - Groundwater drawdown affects of the proposed project and alternatives on adjacent groundwater wells and changes in direction or magnitude of groundwater hydraulic gradient on contribution to surface water flows was not addressed in the EIS/R. The EIS/R Regional Economics section identified "Groundwater substitution transfers could increase groundwater pumping costs for water users in areas where groundwater levels decline as a result of the transfer." as an adverse project impact. Obviously the groundwater section missed this impact, which is a significant impact and must be mitigated. 173
  - Subsidence impacts from groundwater drawdown in the seller service area as a result of the project were not addressed in the EIS/R. The EIS/R only addressed the reduction of groundwater subsidence in the buyer's service area as a benefit. Since groundwater substitution in the sellers area is a significant component to the source of water for transfer, the one sided and biased EIS/R analysis where the beneficial impact is disclosed, but the significant adverse impact is ignored and goes unmitigated and disclosed, There is an egregious violation of the requirements and intent of NEPA and CEQA. 174
  - The amount of groundwater substitution/transfer cannot be greater than the maximum sustainable yield or groundwater aquifer collapse occurs. The Proposed Project does not provide operational limits and the EIS/R analysis does not determine how much water can be sustainably withdrawn from groundwater aquifers without risk of collapsing them. The Proposed Project does not define how much groundwater substitution would occur in each seller area from year to year. With both of these critical information components missing in order to ensure protection of the groundwater aquifers, the EIS/R document is deficient and must be revised to correct these omissions. In order to avoid and mitigate the significant impact of the project on groundwater subsidence, the project must include an alternative 175

for a sustainable rate of groundwater withdrawal and/or propose the sustainable rate of groundwater withdrawal as a mitigation of the impacts of the current Proposed Project and alternatives. This "sustainable groundwater alternative" extraction and transfer amount can be calculated for each seller service area groundwater basin using the following generalized methodology. First, determine the current size (TAF) and annual groundwater recharge for each groundwater basin for the 82 year period of hydrologic record. Second, determine the safe and sustainable annual quantity of groundwater yield (including maximum rate of groundwater withdrawal without collapsing water bearing strata) in each basin. Now add the groundwater basin (with size, recharge rates and maximum sustainable rates of 175
withdrawals) as a "reservoir" for each groundwater basin and seller service area to CALSIM (or in a post processing module for analyzing CALSIM results). Next, using the 82 year period of record and the CALSIM model, optimize the amount of seller area water deliveries for each groundwater basin area. Determine the amount of groundwater extraction for transfer that does not accrue into an over-draft of the groundwater basin at any time during the 82 year period of record. The maximum groundwater substitution amount that does not result in over-drafting the groundwater in any year in the 82 year hydrologic period of record will be the maximum contract delivery amount for that groundwater basin and seller service area for use in the "sustainable groundwater" EIS/R alternative or as a mitigation for the significant groundwater aquifer collapse impacts of the Proposed Project. The EIS/R also fails to identify impacts to infrastructure (roads and bridge structural integrity and safety, canal capacity and structural integrity and safety), and other resources (such as surface water drainage) that occur from groundwater withdrawal caused ground level subsidence.

Geology and Soils

- The EIS/R evaluated the potential loss of top soil from fallowing, but did not address the different soil erosion potentials that occur in different seller areas. The EIS/R analysis must be revised to reflect the site specific soil erosion characteristics at the seller areas; otherwise the 176
analysis is programmatic rather than project specific and would require subsequent environmental analysis prior to implementation of the project.
- The EIS/R did not address salt accumulation and resulting reductions on soil productivity from the water transfers on the buyer areas. The EIS/R analysis must be revised to reflect the 177
continued and increased salt accumulation of soils and reduced soil productivity from the proposed water transfers.
- Water released from CVP or SWP facilities for water transfers is on top of the water that would have been released in the No Action/No Project. Most of the water transfer releases of the Proposed Project will be on top of higher natural flows so that less carriage water is required and water diversion yields of the transferred water will be highest at the south delta pumps. 178
This extra flow increment of the transferred water on top of the flows that would be there under the No Action/No Project will result in increased erosion of banks in the tributary reaches below the dams. As an example of this impact, see DWRs settlement agreement and

compensation to Emerald Farms on the lower Feather River from increased erosion from the SWP operations. These flow related impacts to bank erosion are a real impact of the Proposed Project and alternatives. The EIS/R failed to analyze these identify, characterize, evaluate, quantify, mitigate or disclose these impacts. 178

Air Quality

- The EIS/R identifies a benefit from the reduction of emissions from farm equipment that would not be operated on fallowed water seller fields, but does not address the increase in emissions from farm equipment being operated on buyers fields that would have otherwise been fallowed. This shifting of air quality impacts from farm equipment operations from northern California to the southern central valley is a significant impact as the northern counties generally do not have a problem meeting their air quality attainment requirements and the bay area and southern central valley counties are constantly in violation of their air quality attainment requirements. The EIS/R identification of a beneficial impact while ignoring the more than offsetting corollary significant impact demonstrates the one sided biased nature of the impact assessment. The EIS/R must be revised to disclose and mitigate the air quality impacts of the farm equipment operated in the buyers area under the proposed project which would not occur under the No Action/No Project. 179
- The EIS/R claims that dust from fallowing fields is an overall benefit because there is no tilling and harvest associated dust. This analysis and conclusion is completely biased and is not supportable. Much more soil is eroded from a field that is fallowed and bare of all vegetation all year as compared to a field that is tilled and harvested. This impact is not a benefit, it is a significant impact that must be mitigated. 180
- Increased air pollution from increased groundwater and other pumping (e.g. CVP/SWP lift pumps and groundwater pumps) under the proposed project is a significant impact, not a less than significant impact as the EIS/R determined. This significant impact must be mitigated. 181

Climate Change

- The EIS/R is analysis is fundamentally flawed because the future project condition to 2024 did not include sea level rise, precipitation or other climate change impact assumptions. NEPA requires the end condition of the project period to be analyzed, in this case 2024. The BDCP has incorporated climate change in its analysis of conditions in 2025, so this EIS/Rs omission of climate change for 2024 is a serious inconsistency in how climate change is addressed between these two similar projects. Reclamation is a lead agency on both projects, both projects cover the same water systems and geographic areas and resources; and yet the BDCP addresses climate change in 2025 and this EIS/R does not for 2024. NEPA guidance and specifically USACE and EPA in their analytical requirements for a 401 permit, require consideration of climate change. Department of Interior, USACE and EPA all have specific methods and assumptions which are required to be utilized in an EIS. The project failed to incorporate these methods and assumptions. This EIS/R must be revised to incorporate climate change assumptions in its Proposed Project, Alternatives and No 182

Action/No Project assumptions. A 401 permit for this project must not be issued without analysis that includes climate change that is consistent with Department of Interior, USACE and EPA analytical method requirements and assumptions. 182

- Fallowed fields do not transpire so the cooling effect of the growing crops would not occur in acres fallowed from the implementation of the proposed project or alternatives which include crop idling. Some publications have speculated that the central valley is 10+°F cooler in the summer due to crop irrigation as compared to non-irrigation of the current irrigated acres. The fallowing of crop acres from the project would have similar impacts as those widely recognized for urban heat island effects. The EIS/R is deficient as it did not identify, characterize, evaluate, quantify, mitigate or disclose these impacts and it must be revised to address these omissions. 183
- Greenhouse gas emissions from increased groundwater and other pumping (e.g. CVP/SWP lift pumps and groundwater pumps) is a significant impact, not a less than significant impact as the EIS/R determined. This significant impact must be mitigated. 184

Aquatic Resources

- Increased deliveries of CVP/SWP south of delta service areas of Sacramento Valley basin water supply increases the proportion of "foreign basin" introduction of water and drainage water to the tributaries downstream of the water transfer receiving service areas. The water transfers under the proposed project increases the proportion of foreign basin water into the tributaries downstream of the service areas receiving these transfer waters. The out of basin water has a different signature as a homing cue for anadromous fish, especially salmonids. False attraction of migrating fish from out of basin water is well documented in published literature and is a major problem with central valley salmonid reproductive survival rates and genetic introgression which is a direct threat to the species diversity and viability. The proposed project is particularly problematic for increasing salmonid straying from out of basin water transfers in that the years where the proposed project water transfers are anticipated to be most active are the years where otherwise the CVP/SWP would have the lowest operational impacts on out of basin caused salmonid straying and genetic introgression. 185 As an example, in 2014, CVP and SWP deliveries to the agricultural users that are the proposed project recipients of the water transfers, their 2014 water deliveries from the CVP and SWP were 0%. This means that in 2014 there would have been no straying and genetic introgression from out of basin transfers from these areas for the San Joaquin River and the South San Francisco Bay and their tributaries. With the proposed project, the out of basin transfers would occur on years of low and no CVP and SWP deliveries which will result in an increase in the proportion of out of basin water in the downstream drainage tributaries and in the rate of salmonid straying, associated mortalities and loss of fecundity and genetic introgression impacts on the species genetic integrity and diversity as compared to the No Action/No Project condition. In the case of years with 0% CVP/SWP water deliveries, to go from zero straying impact from the CVP/SWP operations under the No Action/No Project condition to some increased amount of straying impact is

an increase of infinity percent as compared to the baseline condition that occurs without 185
the project water transfers. The EIS/R failed to identify, evaluate, quantify, mitigate or disclose this impact.

- The EIS/R must be revised to evaluate the year to year potential geographic distribution of the sellers and to evaluate the worst case scenario of the distribution (or lack thereof) of the sellers. Since the EIS/R did not evaluate a worst case scenario for how the sales would be distributed, the project must not be approved or permitted for operations that would result in more geographically concentrated impacts than what was represented in the analytical assumptions in the EIS/R. The EIS/R assumed an average water transfer contribution from all seller areas for the available transfer capacity for each water year type. The EIS/R average geographic distribution of water seller assumption for the impact analysis is actually the best case scenario for the least impacts as the impacts are equally spread and are reduced in severity in any geographic location the most of any of the potential operational scenario. Any other scenario of seller distribution would result more significant impacts than the average seller distribution assumption used in the EIS/R analysis. The EIS/R should have conducted and disclosed some sensitivity analysis in which the extremes of operational scenarios were tested and evaluated for their environmental impacts. Several of these scenarios that represented the worst potential impacts from the project should have then been fully evaluated to disclose the range of impacts that could or would be precipitated by implementing the proposed project. Only under that "bookend" of worst case scenarios analytical approach should the project be awarded permits that allow the full amount of water transfer proposed with a full set of mitigations to cover the worst case scenarios that would address these impacts. The current EIS/R analysis took the most optimistic (and
completely unrealistic) assumption of an evenly distributed geographic spread of water 186
transfer operations and impacts. Under the current set of analysis assumption that assumes only average seller water allocation in the transfers, each of the identified seller areas should be only allowed to transfer the averaged amount of water that was actually analyzed in the EIS/R. Any more water than that allowed under the operations would precipitate impacts that were not analyzed, mitigated or disclosed. Here is a description and analysis of the current critically flawed analytical assumptions the EIS/R used in its impact analysis. The maximum proposed water transfer by the identified water sellers is 511,094AF. In all water years except Critical, Consecutive Dry, and Dry after Critical; the FWS OCAP BO says that the maximum transfer that can be conducted under the permitted conditions is 360,000AF (see related comments). The EIS/R makes the erroneous assumption that the 360,000AF would be evenly distributed across the seller's area. In reality, the impacts would never be so perfectly distributed and reduced in their severity. The EIS/R should have, as described earlier in this comment, tested a number of scenarios in which the transfer water was concentrated with various combinations of sellers. The EIS/R should have evaluated the impacts of all of the transfers coming from a single drainage basin under these limited subscription conditions, e.g. all from the Feather River or American River basin and none from the Sacramento River/Shasta drainage basin and visa versa. The scenario of all water transfers from one basin and none from another basin is very plausible as snowpack could favor one basin over another and make more or less water available for transfer or operational considerations of reservoirs in one basin vs. the other could make water storage much more or much less feasible. The EIS/R should have evaluated at least two scenarios of different distribution of willing sellers. These are: all available sellers from the Sacramento and Feather River Service area with none from any of the other seller service areas and

another scenario of all transfers being from Merced River, Delta, American River, Yuba River, and Feather River with none from the Sacramento River. To analyze the salmonid straying effects of the project (see related comments), these scenarios should have also included maximum differences in flow contributions from different operational scenarios for each tributary confluence. At the minimum, these should have included max operations on the Sacramento and no operations on the Feather River and Yuba (and visa versa), max operations on the Feather River and none on the Yuba (and visa versa), max operations on the Sacramento, Feather and Yuba rivers and none on the American (and visa versa). The concept proposed by the project of "backed up water" (see related comments) where water is released earlier in one tributary (e.g. Feather River), water is stored in another tributary basin (e.g. Shasta) and then released later in the other tributary (e.g. Sacramento River) has many more complex flow and water temperature impacts than just the raw number of acre feet in the transfer would indicate by just considering the "upper limits" of transfers as presented in the EIS/R Table 2-5. In the case of "backed up water", the flow impacts on proportional flows at a tributary confluence are doubled. Under the backed up water operational scenario of the proposed project operations, all of the water identified by 186
willing sellers in the Feather and Yuba River and could be released earlier than they otherwise would have in lieu of releases that would have occurred from Shasta. This results in an increase of Feather River flows and a relative decrease in Sacramento River flows at the confluence of the rivers. This is a 2x change in proportional flows at the tributary confluence (e.g. Feather and Sacramento River confluence) (+90,000AF in the Feather River and -90,000AF in the Sacramento River) as compared to the No Action/No Project during the release period. The proposed project does not define when or how short a time period a backed up water transfer could occur (presumably limited by available excess capacity for transfer), but in the absence of supported assumptions provided by the EIS/R we must assume the worst case period of time and volumes so as to be protective of the endangered fisheries species resources. If the analysis does not specify when, where and how these reservoir backup water transfers would occur, the agencies must assume the worst case scenario and limit the project permitted operations accordingly to assure ESA fish protections. Without these potential flow and temperature change analyses at the confluences of the salmonid migratory tributary confluences, the potential impacts of the range of operations that the project has proposed have not been evaluated, quantified, mitigated or disclosed. The EIS/R is deficient for the lack of this analysis which must be rectified when the document is revised and recirculated.

- The Terrestrial species impact analysis determined that "Groundwater substitution could reduce stream flows supporting natural communities in small streams" was a significant impact for alternatives 2 and 3. If groundwater impacts on streams can be significant for 187
terrestrial species, how can it not be significant for aquatic species? The EIS/R must be revised to correct this impact call omission in the aquatic species section.
- Vegetation removal from Bouldin Island was required for a water transfer to Semitropic Water District in 2014. The herbicide application resulted in the damage to 10s of thousands of acres of agricultural crops <u>and wildlife habitat</u>. Since Bouldin Island is in the very middle of the delta, the herbicide spray drift that impacted terrestrial habitat would 188
have also have to have contaminated hundreds of acres of aquatic habitat. In this case the aquatic habitat damaged included designated critical habitat for San Joaquin steelhead and Chinook salmon, green sturgeon, delta smelt and other special status species. Previous

water transfers have proven that this is a real risk of this type of project and these risks must
be evaluated. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or 188
disclose these very real potential impacts of the proposed project. The EIS/R must be
revised and recirculated to address these material omissions and deficiencies in the
document.

Wildlife

- The sellers identified are mostly water districts. When water districts transfer water they
typically rotate the fallowed lands from year to year so not the same fields or owners are
participating from year to year. The EIS/R just assumes there will be some even distribution
of the fallowed fields across a water district. They do put some constraints on adjacency to
wildlife refuges, but other than that, the fallowing could occur in any location or in any
combination of locations or concentrations. By not having specific locations or a very
specific rule set about how fallowed fields can be distributed within a water district, the
analysis of the impacts from field fallowing is at a programmatic level of detail, not a project
site specific level of detail. The rules for how fallowed field are distributed in a water district
are not specific enough to allow detailed analysis of impacts. The lack of specificity of the 189
location and distribution of fields also does not allow for impact analysis to wildlife. There
are some vague assurances from the project about not disrupting habitat corridors, but they
do not say how this would be determined, what threshold of disruption is acceptable or
unacceptable. A single fallowed field is disruptive to habitat connectivity by itself, is that too
much? How about two adjacent fields fallowed, too much or OK? How about 3 contiguous
fields or 30 contiguous fields? The EIS/R assurances to not disrupt habitat are so vague that
these questions cannot be answered and therefore these assurances by the project are
meaningless. The EIS/R must be revised such that project specific levels of detail on the
impacts of field fallowing are conducted. Although the agencies can approve a
programmatic EIS/R, this project, because of its lack of project-level analysis of impacts,
must have a subsequent environmental analysis prior to implementation.
- Farmed fields contribute wildlife habitat values for foraging, refuge, and mating. Fallowed
bare ground impacts wildlife by altering habitat values and uses and overall provides lower
habitat value than a cultivated field, e.g. no flooded rice when fallowed. Loss of habitat on 190
the international flyway, which the seller areas are in a core area of, impact the United
States compliance with the International Migratory Bird Treaty which was not addressed in
the EIS/R.
- Southern Central Valley land that has been fallowed and is put back into production due to a
water transfer will destroy the habitat values that have been created while the field was
fallowed. Some of the species that move into fallowed fields that would have their habitat
destroyed by putting the field back into production by the water made available by the 191
water transfers include giant garter snake, tiger salamander, Alameda whip snake, San
Joaquin kit fox, San Joaquin kangaroo rat, and others. The project failed to quantify and
mitigate these impacts.

- If a field is fallowed for up to 10 years under the Proposed Project, habitat values will be
  created. The project fails mitigate for the destruction of these created habitat values that 192
  will occur at the end of the project period when these lands are put back into production.
- Vegetation removal from Bouldin Island was required for a water transfer to Semitropic
  Water District in 2014. The application of herbicide for vegetation removal resulted in the
  damage to 10s of thousands of acres of agricultural crops and wildlife habitat. In this case
  the habitat damage included critical habitat for giant garter snake, riparian brush rabbit and
  rat, tiger salamander, greater sandhill crane, San Joaquin steelhead and Chinook salmon,
  green sturgeon, delta smelt and other special status species. This spray drift damage has
  been well documented and publicized (http://wineindustryinsight.com/?p=54211,
  http://www.winebusiness.com/blog/?go=getBlogEntry&dataId=135322,
  http://www.lodinews.com/news/article_3c58d352-f196-11e3-8efa-0019bb2963f4.html,
  http://rivernewsherald.org/articles2014/bouldin_8-6-2014.html). Bouldin Island is only 193
  5,900 acres. The proposed project could idle as much as 177,000 acres in a year if it utilized
  its maximum transfer capacity covered under the EIS/R using mostly the crop idling strategy
  component of its proposed project water conservation. If the transfers were maximized for
  the 10 year project period and utilized mostly crop idling as its water conservation strategy
  then over the 10 year project period, there would be as many as 1,770,000 acres that
  required herbicide treatment. If only 1% of the herbicide treatments for the proposed
  project water transfers go as badly as the Bouldin Island water transfer, the impact of these
  water transfers could damage 100s of thousands of acres of wildlife habitat. Previous water
  transfers have proven that this is a real risk of this type of project and these risks must be
  evaluated. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose
  these very real potential impacts of the proposed project. The EIS/R must be revised and
  recirculated to address these material omissions and deficiencies in the document.

Land Use and Agriculture

- Improved irrigation management and scheduling as a water conservation measure should have 194
  been included as a component to some of the alternatives.
- The timing and method of vegetation removal was not adequately defined in the EIS/R to ensure
  water conservation. As an example a previous comment alluded to, Bouldin Island vegetation
  management was very late, so much of what was supposed to be conserved was not. The EIS/R 195
  has failed to provide descriptions, process, monitoring and contingency plans to guarantee idled
  crop land does not continue to transpire and use water that was supposed to be conserved.
- Long term transfers conflict with Williamson Act conservation as long term fallowed ground with 196
  no vegetation is no longer agriculture.
- Transfers include water conserved from “crop shifting”. If a grower was to plant alfalfa (very
  water consumptive use intensive) and then they say they will take that crop out and plant 197
  winter wheat instead and sell the water that was “saved” by not continuing to grow the water
  use intensive crop, it opens the whole project to gaming and false water savings.

- "Cropland idling water transfers could permanently or substantially decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP." was determined in the EIS/R to be a Less Than Significant impact for alternative 2. This is an error as irrigation of the land is a core requirement of the definition of "prime farmland". The proposed project and alternatives take irrigation water away from as much as 177,000 acres in any alternative that includes land fallowing. Alternative 2 includes land fallowing, so it is a significant impact. Alternative 2 may have less of this impact than alternative 4, but it is still significant and must be mitigated. 198
  - The EIS/R fails to identify increased weed pressure on properties adjacent to fallowed fields. This results in additional herbicide applications being required, which has environmental impacts and costs for the adjacent land owner. The EIS/R must be revised to identify, characterize, evaluate, quantify, mitigate and disclose this impact. 199
  - Native grasses and herbaceous plants are slow to colonize highly disturbed soils such as idled agricultural fields so the idled fields are primarily initially colonized by exotic and invasive weed species. The EIS/R failed to identify that the proposed project and alternatives operations would increase weed pressure of exotic and invasive plant species. These exotic and invasive plants also alter habitat value for foraging and refuge for wildlife. 200
  - The EIS/R failed to analyze proposed project impacts on the suitability of water temperatures for agricultural irrigation beneficial uses. The proposed project increased reservoir releases and tributary flows which result in reduced water temperatures farther downstream which in turn results in increased coldwater impacts on crops. DWR's Oroville Facilities reached a settlement agreement with the water districts which are affected by water temperatures being too cold for crop production. The settlement agreement has resulted in more than a million dollars per year in compensation to the affected growers. The proposed project operations at Oroville would add to these impacts. Similarly, cold water affects from releases from Shasta reservoir for the project, could precipitate impacts for growers that divert water at TCID and GCID. The EIS/R failed to identify, evaluate, quantify, mitigate or disclose coldwater affect impacts to agricultural irrigation beneficial uses resulting from the Proposed Project or alternatives. 201
  - The water transfers must be restricted to avoid inducement of more permanent demand such as conversion of annual crops to permanent crops in the buyer service areas. The EIS/R failed to addressed the impacts of the water transfers in conversion of crop land to permanent crops and development of permanent demand as a result of the project. 202
  - Fields adjacent and downwind of fallowed fields have yield losses from hot dry and dusty air being blown from the bare fields. This impact was not addressed in the EIS/R. 203
  - Vegetation removal from Bouldin Island was required for a water transfer to Semitropic Water District in 2014. The herbicide application resulted in the damage to 10s of thousands of acres of agricultural crops. In this case the crop damage included large portions of the Lodi wine grape district. This spray drift damage has been well documented and publicized (http://wineindustryinsight.com/?p=54211, http://www.winebusiness.com/blog/?go=getBlogEntry&dataId=135322, 204

http://www.lodinews.com/news/article_3c58d352-f196-11e3-8efa-0019bb2963f4.html, http://rivernewsherald.org/articles2014/bouldin_8-6-2014.html) and is estimated to have caused as much as $1Billion in damages. Bouldin Island is only 5,900 acres. The proposed project could idle as much as 177,000 acres in a year if it utilized its maximum transfer capacity covered under the EIS/R using mostly the crop idling strategy component of its proposed project water conservation. If the transfers were maximized for the 10 year project period and utilized mostly crop idling as its water conservation strategy then over the 10 year project period, there would be as many as 1,770,000 acres that required herbicide treatment. If only 1% of the herbicide treatments for the proposed project water transfers go as badly as the Bouldin Island water transfer, the impact of these water transfers could be $3 Billion in damages. If you look at the amount of herbicide damage 204 claims associated with water transfer vegetation removal to date, you will find the damage rate is well above 1%. Just talk to some Forensic Agronomists in California that deal with these types herbicide drift cases (e.g. Rush Markroft, Whaley and Stienberg, Bahme and Associates) to get a realistic rate of damages which occur. DWR has a particularly bad track record (probably among the worst in the state when compared to the amount of damages vs. the number of herbicide applied acres) when it comes to damages to third parties from herbicide applications. If the project claims that some or most of the water conservation will not come from crop idling that require herbicide spray weed control, then they must define these limits and analyze and disclose them in the EIS/R. Previous water transfers have proven that herbicide spray drift is a real risk of this type of project and these risks must be evaluated. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose these very real potential impacts of the proposed project. The EIS/R must be revised and recirculated to address these material omissions and deficiencies in the document.

Cultural

- The impact criteria for cultural resources are incorrect. It is not an impact only if the reservoir levels are drawn down below historical levels, it is an impact if the reservoir drawdown from proposed project and alternatives operations that result in an increase of the frequency and magnitude of archaeological site exposure within the fluctuation zone of the reservoirs. Any 205 increase in the frequency or magnitude of exposure of cultural or archaeological resources is a significant impact of the project. As an example of a correct impact criteria for this resource in a similar environmental document, see the Cultural Resources reports from the California Department of Water Resources Oroville Facilities Relicensing.

Recreation

- The impact calls related to reservoir recreation are incorrect. If the proposed project or alternatives result in an increase in the frequency or earlier calendar date of boat ramp 206 dewatering, then the impact is significant and must be mitigated. As an example of a correct impact criteria for this resource in a similar environmental document, see the Recreation

Resources reports from the California Department of Water Resources Oroville Facilities Relicensing. 206

Power

- The EIS/R misses the main impact of the proposed project and alternatives 2 and 4 in the impact of increased energy demand from groundwater pumping and from groundwater level drawdown. The amount of groundwater pumping the project can create definitely could be a significant impact to power resources in northern California, especially with power transmission line capacity constraints in the areas where the groundwater power demand can be anticipated. Additionally, "backed up reservoir" water transfers which are include in the proposed project and all alternatives alter the timing and location (see related comments) of hydroelectric power generation associated with these releases as compared to the No Action/No Project. The EIS/R failed to consider these power generation timing and location, changes in location and timing of power consumption and constraints and impacts on power transmission from the proposed project and alternatives. The EIS/R must be revised to correct these omissions and propose mitigations for these undisclosed significant impacts. 207

Flood Control

- The impact calls relative to project impacts on reservoir storage are flawed. Reservoirs are multipurpose, including flood control and water supply. Flood control comes first in terms of overriding operations as adequate flood control reserve must be managed in the flood control season. If the reservoirs are lower due to proposed project operations, there is no impact to flood control operations as flood control reserve releases are less likely to be triggered and therefore the project has no impact. If flood control reserve releases are activated when the reservoir is fuller due to proposed project operations, the water stored by the project will be spilled first. 208

Regional Economics

- "Water transfers from idling alfalfa could increase costs for dairy and other livestock feed." This impact category misses the fact that alfalfa would be one of the primary crops not grown in the component of the proposed project for "crop shifting". When rotation away from water use intensive forage crops in crop shifting is added to the loss of these crop acres in the fallowing part of the proposed project and alternatives, the impact to forage supplies and feed prices to local dairies the impacts could be significant. 209
- The EIS/R does not disclose if the water transfers are paying proportionate fees for conveyance as the water districts that are paying for the SWP and CVP facilities construction and operations. 210
- Vegetation removal from Bouldin Island was required for a water transfer in 2014. The use of an unregistered combination of herbicides and misapplication of them has resulted in the damage to 10s of thousands of acres of agricultural crops. In this case the habitat damage 211

included critical habitat for giant garter snake, riparian brush rabbit and rat, tiger salamander, greater sandhill crane, San Joaquin steelhead and Chinook salmon, green sturgeon, delta smelt and other special status species. This spray drift damage has been well documented and publicized (http://wineindustryinsight.com/?p=54211, http://www.winebusiness.com/blog/?go=getBlogEntry&dataId=135322, http://www.lodinews.com/news/article_3c58d352-f196-11e3-8efa-0019bb2963f4.html, http://rivernewsherald.org/articles2014/bouldin_8-6-2014.html) and is estimated to have caused as much as $1Billion in damages. Bouldin Island is only 5,900 acres. The proposed project could idle as much as 177,000 acres in a year if it utilized its maximum transfer 211
capacity covered under the EIS/R using mostly the crop idling strategy component of its proposed project water conservation. If the transfers were maximized for the 10 year project period and utilized mostly crop idling as its water conservation strategy then over the 10 year project period, there would be as many as 1,770,000 acres that required herbicide treatment. If only 1% of the herbicide treatments for the proposed project water transfers go as badly as the Bouldin Island water transfer, the impact of these water transfers could be $3 Billion in damages. Previous water transfers have proven that this is a real risk of this type of project and these risks must be evaluated and $3 billion in damages to the crops in the seller service areas from the project is a substantial impact to the agricultural industry and local economies that the EIS/R failed to evaluate. The EIS/R failed to identify, characterize, evaluate, quantify, mitigate or disclose these very real potential impacts of the proposed project. The EIS/R must be revised and recirculated to address these material omissions and deficiencies in the document.

Environmental Justice

- Fallowed ground and shifting to lower water use intensive crops which are typically less labor intensive than more water intensive crops has significant impacts on disadvantaged local communities, employment opportunities, the working poor, and minority farm 212
  workers. Regional economics identifies that 500 people would lose their jobs in the water sellers area from fallowing and crop shifting. The vast majority of these people would be minorities. The EIS/R impact call of "No disproportionately high or adverse effect" is not only incorrect, it is not even a proper NEPA or CEQA impact call.

Growth inducement

- Growth inducement was not a section included in the ES summary. Growth inducement 213
  consideration is a NEPA requirement.
- These water transfers result in an increase of the economic disparity between the value of water used for agriculture vs. M&I uses. M&I water uses can justify costs in excess of a thousand $ per acre foot. Almost no crops can be economically grown at a comparable cost to the values that can be justified for M&I uses. The proposed project water transfers 214
  inducement creation of permanent demand such as for industrial, urban, commercial or permanent crop use because those water uses can always afford to pay more than the value of the water if it were used for normal row crop production. Therefore, creation of this long

term water transfer opportunity from the project has significant growth inducement impact from permanent shifting of water use location and beneficial use that must be evaluated, quantified, mitigated and disclosed by the project. The EIS/R must not be approved until these material deficiencies in how it addresses growth inducing impacts are rectified. 214

- Long-term transfers resulting from this project encourage reliance on this water supply. Annual transfers as an alternative for comparison do not. This difference in growth inducement must be evaluated. 215

Cumulative

- The EIS/R analysis must be specific as to each transfer and cumulatively. This cumulative analysis must be in conjunction with single year water transfers and other long-term transfers such as the Lower Yuba River Accord. 216

LA13

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December 1, 2014

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Re: State Water Contractors' Comments on Draft Environmental Impact Statement/Environmental Impact Report for Long-Term Water Transfers

Dear Mr. Hubbard and Ms. Mizuno:

The State Water Contractors ("SWC") appreciate the opportunity to review and comment on the Draft Environmental Impact Statement/Environmental Impact Report ("EIS/EIR") prepared by the Bureau of Reclamation ("Reclamation") and the San Luis & Delta-Mendota Water Authority ("SLDMWA") for the proposed Long-Term Water Transfers Project (the "Project"). The SWC understand that Reclamation is serving as the lead agency under the National Environmental Policy Act ("NEPA") and that SLDMWA is serving as the lead agency under the California Environmental Quality Act ("CEQA"). These comments are provided by the SWC for both NEPA and CEQA. 1

As Reclamation and SLDMWA know, the SWC is a nonprofit mutual benefit corporation that represents and protects the common interests of its 27 members[1] in California's State Water Project ("SWP"). Collectively, the SWC member agencies utilize the SWP and other facilities to deliver water to more than 26 million residents throughout the state and to more than 750,000 acres of agricultural lands. Hence, the SWC have an interest in any project that may impact SWP water supplies.

[1] The SWC members agencies are: Alameda County Flood Control and Water Conservation District Zone 7; Alameda County Water District; Antelope Valley-East Kern Water Agency; Casitas Municipal Water District; Castaic Lake Water Agency; Central Coastal Water Authority; City of Yuba City; Coachella Valley Water District; County of Kings; Crestline-Lake Arrowhead Water Agency; Desert Water Agency; Dudley Ridge Water District; Empire-West Side Irrigation District; Kern County Water Agency; Littlerock Creek Irrigation District; Metropolitan Water District of Southern California; Mojave Water Agency; Napa County Flood Control and Water Conservation District; Oak Flat Water District; Palmdale Water District; San Bernardino Valley Municipal Water District; San Gabriel Valley Municipal Water District; San Gorgonio Pass Water Agency; San Luis Obispo County Flood Control & Water Conservation District; Santa Clara Valley Water District; Solano County Water Agency; and Tulare Lake Basin Water Storage District.

As described in the EIS/EIR, the Project covers a 10-year period (2015 through 2024) during which water could be transferred between willing sellers and buyers through groundwater substitution, reservoir release, conservation, and other mechanisms. More specifically, the Project would allow Central Valley Project ("CVP") contractors in areas south of the Delta or in the San Francisco Bay area to purchase transferred water. The transferred water would be conveyed to the purchasers by the sellers through the Delta using existing CVP or SWP facilities and pumps. 1

After reviewing the EIS/EIR, the SWC have several questions regarding the Project and its environmental analysis. Accordingly, the SWC respectfully request that Reclamation and SLDMWA provide further discussion regarding the items identified below in order to more fully comply with NEPA, CEQA, and those laws' respective public disclosure and analysis requirements. Specifically, the SWC's questions relate primarily to the analysis of, and mitigation for, potential impacts associated with the Project's groundwater substitution and reservoir re-operation elements.

1. The SWC request that Reclamation and SLDMWA clarify the criteria for assessing the magnitude of impacts.

Based on the SWC's review of the EIS/EIR, it is unclear how thresholds of significance or magnitudes of impacts were utilized to determine whether the Project would result in significant impacts to water supplies. The SWC request that the EIS/EIR be clarified to identify with greater specificity how thresholds were applied in both the groundwater substitution and reservoir re-operation contexts, and what specific magnitude of impacts were used when arriving at a significance conclusion. 2

Similarly, when determining whether the Project would result in significant impacts to groundwater resources as a result of groundwater substitution, the EIS/EIR asks whether the Project would cause "[a] net reduction in groundwater levels that would result in adverse environmental effects or effects to non-transferring parties." (EIS/EIR, p. 3.3-61). Thus, the threshold suggests that <u>any</u> net reduction in groundwater levels or <u>any</u> effect to non-transferring parties (regardless how small) may be significant. 3 The SWC request that the EIS/EIR more clearly identify what standard/magnitude of impact was used for assessing significance. Similarly, the threshold asks whether the Project would result in "adverse environmental effects." The SWC's request clarification regarding how "adverse environmental effects" were assessed and what magnitude of impact was used when reaching the significance conclusions in the EIS/EIR.

Finally, the EIS/EIR could avoid ambiguities by answering the following questions. Is <u>any</u> amount of "permanent land subsidence" considered significant, and how did Reclamation and SLDMWA determine whether "significant groundwater level declines" would occur in the first instance? (See second 4 threshold at EIS/EIR, p. 3.3-61; see also third threshold which appears to be incomplete at EIS/EIR, p. 3.3-61). The SWC request that the EIS/EIR be clarified to more specifically identify how Reclamation and SLDMWA determined the significance/magnitude of Project impacts.

2. The SWC request that Reclamation and SLDMWA expand the analysis of impacts and also clarify the "Environmental Commitments" and Project features that are relied upon to prevent impacts from arising.

a. <u>*The SWC request a further elaboration on the Project's impacts on water supply and surface/groundwater interactions*</u> 5

The discussion of water supply impacts and surface/groundwater interaction confirms the Project's groundwater substitutions will cause reduced Delta Pumping Station exports on an annual basis. (EIS/EIR, p. 3.1-17). However, it is unclear how those reductions were calculated or during which

specific months of the year they are likely to arise. As the EIS/EIR notes, the Biological Opinions ("BiOps") applicable to the Coordinated Operations of the CVP and SWP typically limit the bulk of Delta exports to the months of July through September. (EIS/EIR, pp. ES-9, 1-11). Accordingly, if Project- 5
induced reductions in exports are all concentrated within a narrow-window (particularly during summertime peak exports), the overall impact on water supply may be disproportionately large. The SWC request clarification regarding what month(s) reductions in exports are likely to occur and what impacts to water supply exports may result.

Similarly, the SWC request further discussion regarding the groundwater substitutions. Specifically, the SWC request explanation of which specific surface flows are likely to see the largest flow reductions; when those flow reductions are most likely to manifest; and what the magnitude of those reduced volumes may be. As the EIR acknowledges throughout Section 3.3, the geographic area covered by the Project is large and it hosts a wide variety of hydrological and geologic conditions (annual rainfall, volume of 6
groundwater basin, depth to groundwater, etc.). These varying conditions presumably make certain surface flows more vulnerable to the effects of groundwater substitution impacts than others. (See EIS/EIR, p. 3.1-16 [Figure 3.1-2]). Thus, the EIS/EIR should provide a stream-by-stream discussion of whether flow reductions are likely; when those reductions are likely to arise; and what the magnitude of those reductions may be. As described below, mitigation could then be tailored to more specifically address those impacts.

The EIS/EIR also confirms that reservoir re-operations will cause a drawdown in reservoir levels. (EIS/EIR, p. 3.1-19). It is anticipated that this drawdown volume would, over time, be replaced by water that would otherwise flow downstream. (EIS/EIR, p. 3.1-18). However, and again as the EIS/EIR alludes to, there are certain flow and salinity requirements arising from the BiOps that regulate Delta 7
exports. If water that would normally flow downstream and assist in meeting BiOp requirements is now withheld in upstream reservoirs (for example, flows that would normally enter the Delta from the San Joaquin River), that could reduce the SWC's ability to export water from the Delta, an impact that should be described in greater specificity in the EIS/EIR.

The EIS/EIR also states that reservoir re-operations may result in reservoir drawdowns that require more than one season to refill. (EIS/EIR, p. ES-11). It is unclear how refill would occur, if at all, in periods of multiple drought years akin to the drought conditions that exist today. Ultimately, the SWC request that 8
the EIS/EIR discuss in greater detail how compliance with the BiOps' flow requirements, water quality requirements (such as salinity targets), and release timing requirements would be affected by reservoir re-operations.

With regard to cumulative impacts, the SWC request clarification of the discussion regarding groundwater substitution and reservoir re-operation. The EIS/EIR confirms that the cumulative effects analysis spans a ten year period (2014-2024). (EIS/EIR, p. 3.3-91). However, elsewhere the EIS/EIR states that residual reservoir drawdowns and stream flow effects may linger for more than one season, potentially even after any transfers have been completed. The SWC request further discussion to confirm 9
that the Project's impacts have been captured, including those impacts that may remain even after the 10-year transfer period has concluded. Additionally, it is unclear how the cumulative impacts analysis accounts for the combined pressures of existing CVP and SWP operations, the ongoing drought, the potential effects of BiOps, and other projects. The SWC request that an expanded discussion of those issues be provided.

b. *The SWC request that "Environmental Commitments" and Project features be further specified*. 10

The EIS/EIR puts forward a number of measures intended to prevent water supply impacts from occurring. The SWC appreciate those efforts, and agree that proactive management is appropriate to prevent impacts from arising. However, the SWC believe that the proposal could be improved with more specific details of those measures specified as part of the current EIS/EIR process.

As one example, all transfers (including both groundwater substitution and reservoir re-operation) are subject to a "carriage water" requirement that is aimed at maintaining water quality in the Delta. (EIS/EIR, p. 2-29). It is unclear if this carriage water factors is intended to be duplicative of the stream flow depletion requirement imposed by Mitigation Measure WS-1, or if the carriage water concept is an entirely separate and distinct requirement. 10

As another example, the EIS/EIR states that all reservoir re-operation transfers would be subject to a "refill agreement" between the seller and Reclamation to prevent impacts to downstream users. (EIS/EIR, p. 2-11). However, it is unclear how quickly refill would be required or how such an agreement would be enforced. Likewise, the EIS/EIR states that the refill agreements would require refill of reservoirs only when it would not adversely affect downstream water users." (EIS/EIR, p. 3.1-19). It is unclear to the SWC what standards apply for making that determination and which party (the seller, the buyer, the downstream water user, or DWR/Reclamation) would have the burden to prove or disprove any adverse impact. The SWC request clarification of the specific performance standards and enforcement mechanisms for the refill agreements, such as withholding water to refill reservoirs only occurs during times when Delta water exports are not occurring. 11

The EIS/EIR also confirms that Delta water quality may be adversely impacted by reduced flows or changed timing of flows. Thus, "Reclamation and DWR would need to either decrease Delta exports or release additional flow from upstream reservoirs to meet flow or water quality standards." (EIS/EIR, p. 3.1-16). The SWC request further details on how this Reclamation/DWR process would be implemented; which entity would bear responsibility for documenting the decision; and what factors Reclamation and DWR anticipate applying in deciding whether to cut water supply exports or release upstream reservoir volumes. Similarly, the SWC request elaboration on whether upstream reservoir volumes are likely to be available, particularly as the EIS/EIR elsewhere confirms that total reservoir volume is likely to decrease for more than one season at a time. (See EIS/EIR, p. ES-11). 12

Finally, the EIS/EIR states that transferred water would only be used to meet existing needs and not future or expanded needs. (EIS/EIR, pp. ES-1, 1-1). The SWC request elaboration on how this Project feature will be monitored to ensure that no unanticipated impacts will arise. 13

3. **The SWC request that Reclamation and SLDMWA clarify the mitigation to ensure performance with specific criteria**.

Here – separate and apart from the "Environmental Commitments" and Project feature concerns addressed above – the SWC believe Mitigation Measure WS-1 requires the implementation of a stream flow depletion factor, which will be developed at a future date and subject to change, and which will be designed to offset any water supply impacts and prevent conflict with the "no injury" rule that may otherwise arise from groundwater substitution transfers. (EIS/EIR, p. 3.1-21). However, measure WS-1 does not identify what specific minimum depletion factor would be required. Instead, it appears that this decision is left largely to DWR and Reclamation's future discretion. The SWC request further elaboration on how this factor would be developed and enforced, and the SWC recommend that a minimum stream flow depletion factor percentage be established now as part of the current EIS/EIR process. 14

Likewise, measure WS-1 provides that the stream flow depletion factor will be established "in consultation with buyers and sellers." (EIS/EIR, p. 3.1-21). However, many of the entities that may suffer injury as a result of any approved transfer are actually downstream water recipients that are neither 15
the buyer nor the seller in the transfer. Thus, the SWC request that measure WS-1 be modified to state that any depletion factor will only be established in consultation with buyers, seller, <u>and other potentially affected parties</u>.

Further, measure WS-1 states that no water transfer will be approved if it violates the "no injury rule." (EIS/EIR, p. 3.1-21). The SWC request that the Mitigation Measure be revised to elaborate on who bears 16
the burden of proving/disproving injury, and what information would be relevant to that determination.

Similarly, the SWC request that Mitigation Measure GW-1 be revised to further explain how long-term decreases in surface flows will be prevented or mitigated. As set forth above, the EIS/EIR confirms that surface flows may decrease as a result of increased groundwater pumping. The EIS/EIR confirms that surface flows may experience some decrease over baseline conditions as groundwater basins subsequently recharge. Without further details, it appears that surface water flows may be decreased for a period of 10+ continuous years as transfers result in an ongoing tradeoff between groundwater pumping and groundwater recharge (both of which would reduce flows in surface stream). Thus, the SWC would appreciate further explanation of how Mitigation Measure GW-1 will prevent that long-term reduction in 17
surface flows from occurring. One recommendation is to provide a body-by-body performance standard that states how much reduction in surface water flows would be allowed and over what time period in order to assure that no significant impacts result.

In conclusion, the SWC thank Reclamation and the SLDMWA for the opportunity to review and comment upon the EIS/EIR. The SWC appreciate the Project's overall goal of increasing flexibility and reliability with regard to management of CVP water supplies. However, the SWC do request that Reclamation and SLDMWA expand on the issues identified above in order to comply with CEQA and NEPA. SWC believe it is necessary to provide a fuller and more complete environmental analysis under NEPA and CEQA to help ensure that the Project does not provide a benefit to certain water providers to the potential detriment of others.

Should you have any questions, please do not hesitate to contact me at (916) 447-7357 ext. 203.

Sincerely,

Terry Erlewine
General Manager

LA14

County of Yolo
Founded 1850

COUNTY OF YOLO

Office of the County Administrator

Patrick S. Blacklock
County Administrator

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December 1, 2014

Brad Hubbard
United States Bureau of Reclamation
2800 Cottage Way, MP-410
Sacramento, CA 95825

Frances Mizuno
San Luis and Delta-Mendota Water Authority
P.O. Box 2157
Los Banos, CA 93635

Re: Comments on Draft EIS/EIR on Proposed Long-Term Water Transfers

Dear Mr. Hubbard and Ms. Mizuno:

The County of Yolo ("County") submits this letter to provide its initial comments on the Long Term Water Transfers Draft Environmental Impact Statement/Environmental Impact Report ("Draft EIS/EIR"). The County is continuing to review the Draft EIS and may submit further comments in early 2015.

1

Altogether, the Executive Summary of the Draft EIS/EIR indicates that up to <u>86,000 acre-feet of surface water</u> could be transferred each year from 2015 through 2024 from properties within Yolo County to buyers in the San Luis & Delta-Mendota Water Agency ("SLDMA") service area, as well as the Contra Costa Water District and East Bay Municipal Utility District. The County's comments focus on proposed transfers within Yolo County and, in particular, on the potential transfer of up to 35,000 acre-feet annually ("af/yr") from Conaway Ranch. Notwithstanding this letter's focus on transfers from Yolo County, however, the following comments apply equally to other proposed transfers and the Draft EIS/EIR generally.

1. General Comments.

2

As an overall matter, the County disagrees with the conclusion that Alternative 2 (the "Proposed Action" analyzed in the Draft EIS/EIR) will not have any significant, unavoidable adverse effects. Even considering the "environmental commitments" described in Chapter 2 of the Draft EIR/EIS, it is objectively unreasonable to conclude that the potential transfer of slightly over 500,000 af/yr and associated groundwater substitutions, cropland idling, and other measures within the selling areas will somehow <u>not</u> cause any significant, unavoidable adverse effects. There are a host of specific reasons why this conclusion is inappropriate, including an overreliance on assumptions that lack a sound evidentiary basis and other factors discussed in the following section of this letter.

3

Altogether, these analytical flaws distort the comparison of the Proposed Action to other alternatives that could reduce environmental effects associated with cropland idling (Alternative 3) and groundwater substitutions (Alternative 4). The deficient analysis of the Proposed Action's environmental effects compromises the analysis of Alternatives 3 and 4, as well as the ultimate conclusion that those alternatives are not "environmentally superior" to the Proposed Action. 3 The timeframe for analysis—a ten-year period between 2015 and 2024—is also artificial and appears to have been contrived for the purpose of environmental analysis, independent of any proposed transactions or other relevant factors. A shorter transactional timeframe (such as five years) should be used to ensure that environmental effects are appropriately studied as they become apparent, rather than dismissed several years from now by virtue of the inappropriate use of a ten-year period in the Draft EIS/EIR. 4

These fundamental flaws in the Draft EIS/EIR are alone sufficient to support revising the document in several respects, as noted more specifically below. The Draft EIS/EIR should also be recirculated for further public review after these deficiencies are addressed. 5

2. Issue-Specific Comments.

The County's specific comments fall into three categories: (A) subsidence and public safety; (B) agricultural and economic impacts; (C) impacts on terrestrial species, including migratory waterfowl.

A. Subsidence and Public Safety.

The Draft EIS/EIR fails (albeit understandably) to consider recent information relating to subsidence on the Conaway Ranch during the Summer of 2014. A copy of the report on subsidence produced by MBK Engineers on November 12, 2014 is attached hereto. As that report documents, portions of the Conaway Ranch subsided by up to 17 centimeters (6.5 inches) in a three-month period. That three-month period coincided with the transfer of about 25,000 af of surface water to the Tehama-Colusa Canal Authority via groundwater substitution. 6

The County acknowledges that it is not possible to determine the relative contribution of increased groundwater pumping and the fallowing of thousands of acres of farmland on Conaway Ranch to the observed subsidence. However, the overall circumstances support a serious concern that further surface water transfers will cause or contribute to similar effects if up to 35,000 af/year is transferred from Conaway Ranch in the future (in addition to 10,000 af/year that Conaway Preservation Group is contractually obligated to deliver to local cities). This concern is particularly acute because the Yolo Bypass passes through Conaway Ranch. The levees of the Yolo Bypass are already known to suffer from various deficiencies, as documented in the Draft EIR for the Central Valley Flood Protection Plan in 2012 and numerous other public documents. Subsidence can further compromise levee integrity (Draft EIS/EIR at p. 3.3-28) and, in turn, increase public safety risks within Yolo County. 7

Further analysis is required in the Draft EIS/EIR to determine the potential magnitude of such effects and, in addition, to enable proper consideration of the findings required for surface water transfers by Water Code § 1745.10 (relating to conditions of long-term overdraft in affected groundwater basins). These are serious concerns that deserve specific attention in the Draft EIS/EIR, which should be recirculated after it is revised to include a discussion of the new information available on subsidence within the Conaway Ranch. The potential for adverse short-term subsidence effects should also be considered, as even subsidence of a limited duration could impact levee integrity and increase public safety risks (as well as the environmental consequences of large-scale inundation of urban areas if the Yolo Bypass levees fail). 8

In addition, Mitigation Measure GW-1 (Monitoring Program and Mitigation Plans) is legally inadequate. By its own terms, it applies only if "substantial adverse impacts" are determined to occur as a consequence of increased groundwater pumping due to surface water transfers. (Draft EIS/EIR at p. 3.3-90.) It assumes, without any apparent basis, that such "substantial adverse impacts" are entirely reversible and can be reduced to a less than significant level through mitigation plans backed by "financial assurances." Much more is needed to explain the conclusion that such mitigation plans will be effective, that adequate financial assurances can be provided (particularly for impacts on major public infrastructure such as levees), and that Mitigation Measure GW-1 is otherwise sufficient in all instances to reduce even the short-term adverse effects of subsidence and other effects of groundwater pumping to a less than significant level. Additionally, the Draft EIS/EIR should study mitigation measures (or project alternatives) that include common-sense approaches such as lower levels of transfers and/or related groundwater pumping. 9

B. Agricultural and Economic Impacts.

10

The Executive Summary of the Draft EIS/EIR explains that the proposed transfers are primarily intended is to support agriculture within SLDMA boundaries. Ironically however, all of the identified drawbacks of the "no action alternative" in the Draft EIS/EIR--increased groundwater pumping, cropland idling, and land retirement within the SLDMA--could occur within the selling areas if the transfers proceed. These effects range from minor to significant, as explained in Chapter 3.9 of the document.

11

Despite this, the Draft EIS/EIR does not contain sufficient mitigation measures or other constraints upon the proposed transfers to ensure that the adverse effects of water shortages are not simply transferred from the SLDMA to the selling areas. There is no legal or practical reason why this should be so. For instance, the Draft EIR/EIS could easily contain safeguards that limit transfers to the extent necessary to avoid environmentally and/or economically significant effects on groundwater pumping, cropland idling, and land retirement within the selling areas. Such mitigation measures (or project alternatives) should be included for consideration in a recirculated version of the Draft EIS/EIR. More detailed consideration of the potential for Alternatives 3 and 4 to reduce such effects should also be included in the recirculated document.

12

The Draft EIS/EIR also takes an inappropriately narrow view of "agricultural impacts." It focuses largely on whether cropland idling and changes in cropping patterns will "substantially decrease" the amount of affected farmland designated Prime Farmland, Farmland of Statewide Importance, or Unique Farmland during the limited term of the transfer program studied in the Draft EIS/EIR. This impact is deemed less than significant under Alternative 2, primarily because cropland idling will be for relatively short periods of time during the ten-year duration of the studied transfers.

13

This analytical approach is flawed because the water transfers facilitated by the Draft EIS/EIR will lead to continued demand (post-2024) for additional water transfers to support agricultural, municipal, and industrial uses within the boundaries of the SLDMA and other purchasing entities. For this reason, the ten-year term of the environmental analysis is entirely artificial. It has no connection to real-world demands, which will extend long past 2024, nor does it have any apparent connection to legal or other characteristics of the proposed transfers. A short-term view of the environmental and economic effects of creating a water transfer program is therefore inappropriate because it can be seen with reasonable certainty that, analogous to the growth-inducing effects of urban development projects, the demand for such transfers will continue beyond the limited life of the program. The Draft EIS/EIR should be revised to account for the basic reality that water transfers will lead to (and likely increase the demand for) more water transfers, well beyond the ten-year period of the analysis.

14

Finally, the potential adverse economic impacts of the proposed transfers are considerable, particularly within Yolo, Colusa, and Glenn Counties. The Draft EIS/EIR notes that, among other things, over 40,000 acres in rice land alone in the Sacramento Region may not be farmed due to the potential water transfers. In those three counties alone, up to 362 jobs may be lost and the projected declines in labor income and economic output are \$11.1 million and \$45.46 million, respectively.

15

These economic effects (and the related potential for indirect environmental effects) deserve considerably more analysis. To use one example, the potential decline of rice cultivation in the Yolo Bypass due to water transfers, ecosystem restoration, and other projects (which should be included in an analysis of cumulative impacts) could lead to a “tipping point”—meaning that rice cultivation ceases to be commercially viable even on unaffected lands throughout the County—due to a decline in rice volumes, the resulting closure of local rice mills, and the eventual rise of unit processing costs to unacceptable levels. None of this appears to have received meaningful consideration in the Draft EIS/EIR.

C. Impacts on Terrestrial Species, Including Migratory Waterfowl.

16

The Draft EIS/EIS concludes that potential adverse effects on habitat availability and suitability for terrestrial species due to cropland idling/shifting under Alternatives 2 and 4 would be less than significant. This is simply wrong, particularly (though not only) for species that depend on flooded agricultural fields and associated irrigation waterways. Not only does this analytical shortcoming render the Draft EIS/EIR deficient under the California Environmental Quality Act (“CEQA”) and the National Environmental Policy Act (“NEPA”), it also calls into question whether the proposed transfers meet the requirements of the Central Valley Project Improvement Act of 1992 (which prohibits water transfers will adversely affect water supplies for fish and wildlife) and similar provisions of the California Water Code (e.g., Cal. Water Code §§ 1725 and 1736). 16

For the giant garter snake, the analysis of these issues in the Draft EIS/EIR is particularly deficient. The analysis at pp. 3-8.68 through 3-8.70 is highly general and simply states the obvious (i.e., that some individual members of the species will be subject to increased predation and other risks due to habitat displacement) before concluding that impacts are unlikely to be significant. The conclusion appears to be nothing more than speculation. 17

Also, the "environmental commitments" described at p. 2-29 are unlikely to be sufficient to protect giant garter snake populations in Yolo County. The commitments primarily limit restrictions on transfers from fields "abutting or immediately adjacent to" the "land side" of the Toe Drain along Willow Slough and Willow Slough Bypass in Yolo County. (Draft EIS/EIS at p. 2-29.) This very narrow restriction that fails to fully account for the wide distribution of the giant garter snake across parcels <u>not</u> immediately adjacent to the Toe Drain. Accordingly, the Draft EIS/EIR does not sufficiently explain how this restriction supports a conclusion that impacts will be less than significant. 18

Similarly troubling is the complete absence of any analysis of the potential effects of the proposed water transfers on the Swainson's hawk or migratory waterfowl. Numerous passages in Chapter 3-8 indicate that the authors of the Draft EIS/EIR understand that agricultural fields and natural communities affected by the proposed transfers currently support abundant Swainson's hawk and migratory waterfowl populations. Despite this, however, there is no meaningful analysis of potential impacts on the Swainson's hawk or migratory waterfowl. Effects resulting from the fallowing of fields--and for migratory waterfowl, particularly the loss of up to 40,000 in rice annually--need to be analyzed carefully in the Draft EIS/EIR. 19

* * *

Overall, as this letter describes, the Draft EIS/EIR needs significant revisions and recirculation to meet the requirements of CEQA and NEPA. The County requests notice of any hearings or other public discussions of the Draft EIS/EIR or the water transfers studied therein, as well as copies of any documents subsequently produced under CEQA or NEPA for the proposed transfers. Such notice is required by CEQA, as the County is a "responsible agency" within the meaning of that statute. As noted above, the County is continuing to review the Draft EIS and may submit further comments in early 2014. 20

Very truly yours,

Patrick S. Blacklock
Yolo County Administrator

Enclosure

cc: Yolo County Board of Supervisors

MBK ENGINEERS
Water Resources ◆ Flood Control ◆ Water Rights

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1913-1985

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Consultants:
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November 12, 2014

RECEIVED
NOV 14 2014
YOLO COUNTY COUNSEL

Richard Woodley
U.S. Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95821

Subject: Conaway Preservation Group 2014 Water Transfer Second Land Subsidence Report

Dear Mr. Woodley:

On behalf of Conaway Preservation Group (CPG), the purpose of this letter is to provide the enclosed Survey Control Project Report (Report) requested pursuant to Paragraph 16 of the Agreement Among the United States, CPG, and the Tehama-Colusa Canal Authority to Provide for Additional Water from the Central Valley Project for 2014, dated May 19, 2014 (Agreement). The Report details the results of a land subsidence monitoring survey conducted at the end of the 2014 irrigation season for CPG by Frame Surveying & Mapping in accordance with the approach identified in Exhibit E to the Agreement. The Report includes a comparison of the survey results with the initial land subsidence survey results transmitted to your office by letter dated August 28, 2014. A third land subsidence monitoring survey will be conducted prior to the start of the 2015 irrigation season; and following that survey, the results will be documented in a report to be provided in a future update pursuant to Exhibit E.

Please call if you have any questions or require additional information.

Sincerely,
MBK ENGINEERS

Darren Cordova

Enclosures
cc: Robert Thomas, Conaway Preservation Group
Regina Cherovsky, Conaway Preservation Group
Mike Hall, Conaway Preservation Group
Andrew Hitchings, Somach, Simmons & Dunn
Tim Durbin, Tim J. Durbin, Inc.
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Sheri Looper, U.S. Bureau of Reclamation
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SURVEY CONTROL PROJECT REPORT

CONAWAY RANCH LAND SUBSIDENCE MONITORING
SEPTEMBER, 2014 MONITORING EVENT

PURPOSE

This report describes the results of the second monitoring event of the Conaway Ranch subsidence monitoring project. The initial (baseline) measurements were described in a June, 2014 report, which is a companion document to this report.

EXECUTIVE SUMMARY

Of the 10 monitoring stations within the immediate project area, measurable subsidence was detected at 6 of the stations. The measured subsidence ranged from 5 cm to 17 cm, with the largest value found at station SM10, which is located near the ranch headquarters and also near the DWR extensometer. Estimated measurement accuracy is 2 cm. See Appendix A for a graphical approximation of subsidence distribution.

MONITORING EVENT DESIGN

As with the June measurements, the September monitoring event consisted of 30-minute minimum GPS observation sessions at all monitored stations. OPUS Projects was used to establish current ellipsoid heights at 8 stations in and near the project area.

The only terrestrial measurement in the September event was a trig leveling check between SM10 and the nearby EX11, which was performed in response to the relatively large movement detected at SM10. It was determined that EX11 had subsided 0.016 m less than SM10. The June measurements to FERR and CONA were made to tie the project to the Yolo Subsidence Network, but aren't considered necessary to the ongoing monitoring effort.

DATA PROCESSING AND ADJUSTMENT

Substantially duplicating the process followed in June, GPS data files greater than 2 hours in length were processed in OPUS Projects, and the resulting adjustment again constrained stations LNC2, P267, P268 and SACR. The ellipsoid heights of the constraining stations showed very little change between the June and September events – 5 mm or less – validating the selection of these stations as stable vertical constraints.

TABLE E			
STATION POSITIONS - CCS83 US SURVEY FEET			
STATION	NORTHING	EASTING	ELEVATION
1031	2008599.383	6644606.877	33.236
CAST	1967456.543	6663504.495	17.005
COD1	1977287.674	6659463.132	21.206
COY1	1977246.445	6649648.950	27.478
CR27	1987259.421	6648517.853	29.651
EX11	1997336.718	6656626.527	24.513
P268	1934465.509	6662900.456	25.804
P271	2001341.660	6643182.771	42.554
RIVE	1997860.863	6683832.685	39.235
S16A	2008423.129	6663149.765	27.723
SM08	1987046.351	6662905.689	21.206
SM09	1988144.768	6673466.416	18.500
SM10	1997409.582	6656970.177	30.939
SM11	2006681.702	6655241.391	23.129
UCD1	1957204.975	6632828.912	102.613

HEIGHT COMPARISONS, SEPTEMBER 2014 – JUNE 2014

Table F below shows the difference in station height between the September and June 2014 monitoring events. A negative delta value indicates that a station has subsided.

These values constitute the data from which the subsidence contours shown in Appendix A were developed. Reiterating the cautionary note from Appendix A, these contours are based on interpolating between the very sparse data points available from the survey. While they are useful for showing in broad strokes the distribution of subsidence, they are not to be regarded as accurate except in the immediate vicinity of the individual monitoring stations.

TABLE C			
GEOGRAPHIC STATION POSITIONS			
STATION	LATITUDE	LONGITUDE	ELLIP HT (M)
1031	38-40-38.146911	121-42-34.079974	-20.568
CAST	38-33-50.779180	121-38-37.806580	-25.807
COD1	38-35-28.114860	121-39-28.223014	-24.459
COY1	38-35-28.054244	121-41-31.836450	-22.597
CR27	38-37-07.071749	121-41-45.661002	-21.847
EX11	38-38-46.406630	121-40-03.026719	-23.288
P268	38-28-24.681149	121-38-47.027881	-23.431
P271	38-39-26.447882	121-42-52.326075	-17.804
RIVE	38-38-50.462947	121-34-20.065279	-18.774
S16A	38-40-35.753116	121-38-40.255181	-22.202
SM08	38-37-04.450378	121-38-44.384113	-24.364
SM09	38-37-14.880094	121-36-31.260494	-25.163
SM10	38-38-47.114446	121-39-58.691662	-21.328
SM11	38-40-18.832764	121-40-20.061430	-23.630
UCD1	38-32-10.449924	121-45-04.379784	0.014

TABLE D			
STATION POSITIONS - CCS83 Meters			
STATION	NORTHING	EASTING	ELEVATION
1031	612222.316	2025280.227	10.131
CAST	599681.954	2031040.232	5.183
COD1	602678.488	2029808.422	6.464
COY1	602665.922	2026817.054	8.375
CR27	605717.883	2026472.295	9.038
EX11	608789.449	2028943.823	7.472
P268	589626.267	2030856.121	7.865
P271	610010.158	2024846.158	12.971
RIVE	608949.209	2037236.277	11.959
S16A	612168.594	2030932.110	8.450
SM08	605652.939	2030857.716	6.464
SM09	605987.737	2034076.632	5.639
SM10	608811.658	2029048.568	9.430
SM11	611637.806	2028521.633	7.050
UCD1	596557.269	2021690.296	31.277

accurate depiction of the distribution of that subsidence. If a more precise model of subsidence distribution is desired, the network of monitoring points will need to be densified. This can be accomplished by supplementing the rigorous static GPS network with infill measurements captured by means of more rapid – though slightly less accurate – GPS techniques.

TABLE F			
ORTHOMETRIC HEIGHT COMPARISONS			
SEPTEMBER 2014 - JUNE 2014 (METERS)			
STATION	**09/2014**	**06/2014**	**Δ ELEVATION**
1031	10.131	10.183	-0.053
CAST	5.183	5.170	0.013
COD1	6.464	6.475	-0.012
COY1	8.375	8.414	-0.039
CR27	9.038	9.125	-0.087
EX11	7.472	7.628	-0.156
P268	7.865	7.867	-0.002
P271	12.971	13.023	-0.053
RIVE	11.959	11.983	-0.024
S16A	8.450	8.445	0.004
SM08	6.464	6.471	-0.007
SM09	5.639	5.628	0.011
SM10	9.430	9.602	-0.172
SM11	7.050	7.121	-0.071
UCD1	31.276	31.295	-0.019

DWR EXTENSOMETER DATA, SEPTEMBER – JUNE 2014

Data from the Conaway Extensometer is available at

http://www.water.ca.gov/waterdatalibrary/docs/Hydstra/docs/09N03E08C004M/POR/GROUND_SURFACE_DISPLACEMENT_POINT_DATA.CSV

This data indicates that between June 10, 2014 and September 4, 2014 the ground surface was displaced downward 0.12 m (0.42 foot) at the extensometer site. This substantially corroborates the change in elevation shown in Table F above.

SUMMARY

The orthometric height values determined by this survey have an estimated accuracy of +/- 2 cm at the 95% confidence level. Although many of the 95% error estimates for heights shown in the Star*Net adjustment report (see Appendix D) are smaller by a magnitude, empirical evidence has demonstrated that GPS height transfer is not reliably accurate at that level.

The results of this survey document land subsidence on the Conaway Ranch that occurred during the Summer 2014 season. However, the nature of the monitoring network does not permit

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

NGS OPUS-PROJECTS NETWORK ADJUSTMENT REPORT

All coordinate accuracies reported here are 1 times the formal uncertainties from the solution. For additional information: geodesy.noaa.gov/OPUS/Using_OPUS-Projects.html#accuracy

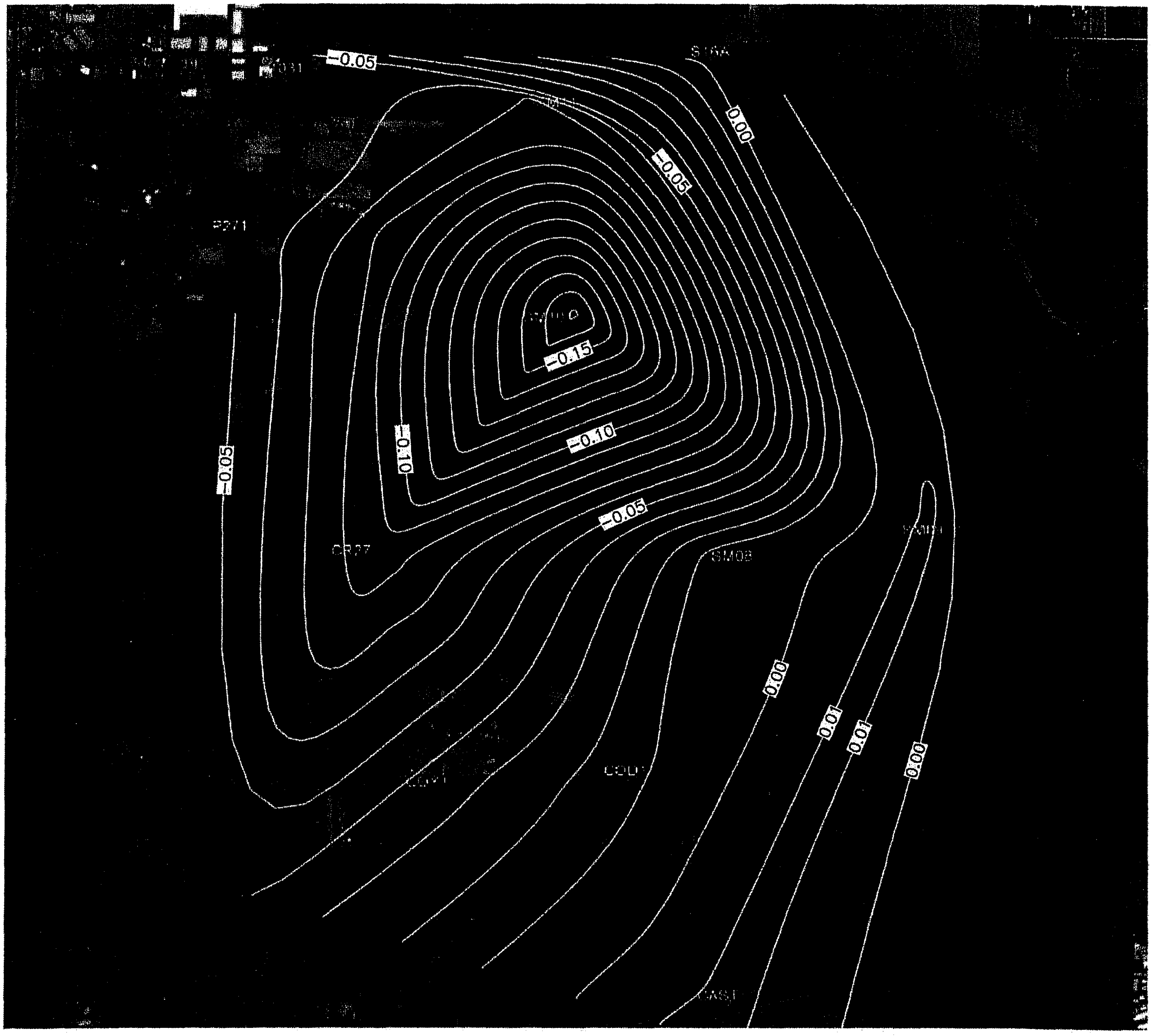
These positions were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

SUBMITTED BY:	jhframe
SOLUTION FILE NAME:	network-network-20140907-LNC2-P267-P2.sum
SOLUTION SOFTWARE:	GPSCOM(1210.24)
SOLUTION DATE:	2014-09-07T20:06:48 UTC
STANDARD ERROR OF UNIT WEIGHT:	0.500
TOTAL NUMBER OF OBSERVATIONS:	829229
TOTAL NUMBER OF MARKS:	16
NUMBER OF CONSTRAINED MARKS:	4

START TIME:	2014-09-03T00:00:00 GPS
STOP TIME:	2014-09-04T23:59:30 GPS
FREQUENCY:	L1-ONLY TO ION-FREE [BY BASELINE LENGTH]
OBSERVATION INTERVAL:	30 s
ELEVATION CUTOFF:	15 deg
TROPO INTERVAL:	1800 s [STEP-OFFSET PARAMETERIZATION]
DD CORRELATIONS:	ON

INCLUDED SOLUTION	RMS	SOFTWARE	RUN DATE
1) 2014-246 A	1.1 cm	GPSCOM(1210.24)	2014-09-07T19:41 UTC
2) 2014-246 B	1.3 cm	page5(1404.11)	2014-09-07T18:54 UTC
3) 2014-247 A	0.9 cm	GPSCOM(1210.24)	2014-09-07T19:30 UTC
4) 2014-247 B	0.9 cm	GPSCOM(1210.24)	2014-09-07T19:35 UTC

BASELINE	LENGTH	RMS	OBS	OMITTED	FIXED	IN SOLUTION(S)
1031-p271	2.254 km	0.4 cm	1566	0.4%	100.0%	1
coy1-cod1	2.992 km	0.5 cm	6924	2.5%	100.0%	2, 3, 4
sm08-cod1	3.154 km	0.6 cm	6951	4.4%	100.0%	2, 3, 4
sm10-sm08	3.640 km	0.6 cm	14526	3.6%	96.9%	1, 2, 3, 4
s16a-sm10	3.849 km	0.5 cm	3397	0.8%	100.0%	1, 4
p271-sm10	4.370 km	0.8 cm	17341	2.2%	100.0%	1, 2, 3, 4
sm08-coy1	5.025 km	0.6 cm	6216	1.4%	100.0%	3, 4
sm10-1031	5.083 km	0.6 cm	1565	0.5%	100.0%	1
s16a-1031	5.652 km	0.5 cm	957	2.6%	100.0%	1
s16a-p271	6.458 km	0.5 cm	1915	0.9%	100.0%	4
sm08-s16a	6.516 km	0.7 cm	3741	2.1%	100.0%	1, 4
coy1-sm10	6.539 km	0.6 cm	6300	0.5%	100.0%	3, 4
sm08-p271	7.425 km	0.9 cm	6409	2.5%	100.0%	1
coy1-p271	7.604 km	0.7 cm	6274	1.0%	100.0%	3, 4
ucd1-coy1	7.975 km	0.9 cm	6270	0.3%	100.0%	3, 4
ucd1-cod1	10.168 km	0.7 cm	2157	3.8%	100.0%	2
ucd1-p268	11.492 km	1.0 cm	57113	0.3%	100.0%	1, 3, 4
ucd1-sm08	12.915 km	1.0 cm	6361	2.5%	100.0%	1
p268-cod1	13.095 km	0.9 cm	7111	2.2%	100.0%	2, 3, 4
coy1-p268	13.651 km	0.9 cm	6310	0.3%	100.0%	3, 4
p271-ucd1	13.819 km	0.9 cm	56921	0.7%	98.8%	1, 3, 4



NOTES

1. SUBSIDENCE VALUES REPRESENT MOVEMENT DETECTED BETWEEN JUNE 10, 2014 AND SEPTEMBER 4, 2014.

2. CONTOUR LINES SHOWN WERE DERIVED FROM SPARSE DATA AND ARE INTENDED TO DEPICT APPROXIMATE SUBSIDENCE DISTRIBUTION ONLY EXCEPT IN THE IMMEDIATE VICINITY OF MONITORING STATIONS.

3. ABSOLUTE VALUES SMALLER THAN 0.02 METER ARE NOT CONSIDERED SIGNIFICANT DUE TO THE LIMITS OF THE MEASURSUREMENT TECHNOLOGY.

FSM
FRAME SURVEYING & MAPPING
609 A STREET DAVIS, CA 95616
530.756.8584 (v&f) jhframe@dcn.org
1037-001

SUBSIDENCE CONTOURS

CONAWAY RANCH SUBSIDENCE MONITORING EVENT
SEPTEMBER, 2014 SCALE: 1"= 2000'
SUBSIDENCE VALUES SHOWN IN METERS

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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UNCONSTRAINED MARKS
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MARK:      1031 (1031    1)

REF FRAME:         NAD_83(2011) (2010.0000)               IGS08 (2014.6730)
X:               -2620586.835 m    0.002 m        -2620587.718 m    0.002 m
Y:               -4241524.000 m    0.002 m        -4241522.693 m    0.002 m
Z:                3964397.371 m    0.002 m         3964397.344 m    0.002 m
LAT:            38 40 38.14700     0.001 m      38 40 38.15946      0.001 m
E LON:         238 17 25.92000     0.001 m     238 17 25.86048      0.001 m
W LON:         121 42 34.08000     0.001 m     121 42 34.13952      0.001 m
EL HGT:               -20.585 m    0.002 m             -21.108 m    0.002 m
ORTHO HGT:             10.113 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)     4281753.255 m       612222.319 m
EASTING (X)       612257.527 m      2025280.226 m
CONVERGENCE       0.80658090 deg     0.18317207 deg
POINT SCALE       0.99975518         0.99993980
COMBINED FACTOR   0.99975841         0.99994303

US NATIONAL GRID DESIGNATOR: 10SFH1225781753 (NAD 83)

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MARK:      casr (casr a  1)

REF FRAME:         NAD_83(2011) (2010.0000)               IGS08 (2014.6726)
X:               -2705828.432 m    0.001 m        -2705829.321 m    0.001 m
Y:               -4207167.175 m    0.002 m        -4207165.810 m    0.002 m
Z:                3943880.560 m    0.002 m         3943880.595 m    0.002 m
LAT:            38 26 26.41470     0.001 m      38 26 26.42904      0.001 m
E LON:         237 15 10.83511     0.001 m     237 15 10.77384      0.001 m
W LON:         122 44 49.16489     0.001 m     122 44 49.22616      0.001 m
EL HGT:                11.968 m    0.002 m              11.467 m    0.002 m
ORTHO HGT:             43.427 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)     4254740.503 m       586187.630 m
EASTING (X)       522080.014 m      1934786.767 m
CONVERGENCE       0.15729779 deg    -0.47095370 deg
POINT SCALE       0.99960600         0.99997739
COMBINED FACTOR   0.99960412         0.99997551

US NATIONAL GRID DESIGNATOR: 10SEH2208054740 (NAD 83)
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p268-sm08	16.027 km	1.1 cm	17523	3.3%	100.0%	1, 3, 4
ucd1-p267	18.412 km	1.0 cm	56766	1.0%	100.0%	1, 3, 4
p268-p267	18.585 km	0.9 cm	76118	0.8%	100.0%	1, 2, 3, 4
sacr-lnc2	21.262 km	1.5 cm	35562	3.2%	100.0%	1, 2
s16a-sacr	25.379 km	1.2 cm	1974	3.9%	100.0%	1
sm08-sacr	25.707 km	1.6 cm	11738	3.9%	88.9%	1, 2
lnc2-s16a	31.759 km	0.9 cm	4209	0.8%	100.0%	1, 4
p268-sacr	32.469 km	1.4 cm	17971	2.2%	94.3%	1
lnc2-sm10	35.312 km	1.1 cm	6534	2.5%	100.0%	3
lnc2-sm08	36.090 km	1.1 cm	11122	3.3%	100.0%	3, 4
p271-lnc2	37.975 km	0.9 cm	37938	0.8%	96.3%	3, 4
p267-p261	42.752 km	0.9 cm	37922	1.0%	100.0%	3, 4
p268-lnc2	48.759 km	0.9 cm	38122	0.3%	100.0%	3, 4
p261-ucd1	58.923 km	1.0 cm	37904	0.4%	100.0%	3, 4
lnc2-cho5	70.520 km	1.0 cm	18787	1.3%	96.6%	1
p271-p261	71.169 km	0.9 cm	38068	0.5%	98.2%	3, 4
p267-casr	80.959 km	1.1 cm	18714	1.6%	98.4%	1
p267-s300	82.582 km	0.9 cm	18896	0.7%	98.1%	1
1031-cho5	83.947 km	0.8 cm	1542	1.8%	100.0%	1
cho5-s16a	83.951 km	1.0 cm	2304	0.7%	100.0%	1
casr-ucd1	87.522 km	1.2 cm	18719	1.0%	95.1%	1
s300-p268	89.915 km	0.9 cm	18999	0.3%	100.0%	1
p271-casr	93.160 km	1.2 cm	18686	1.8%	100.0%	1
casr-1031	94.167 km	1.3 cm	1551	0.3%	100.0%	1
sacr-s300	111.173 km	1.4 cm	17897	1.9%	98.4%	1
casr-s300	135.166 km	1.2 cm	18823	0.4%	92.7%	1
cho5-casr	144.661 km	1.3 cm	18515	2.5%	95.7%	1

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK:      coy1 (coy1    1)

REF FRAME:          NAD_83(2011) (2010.0000)                IGS08 (2014.6757)
X:                -2622442.280 m    0.001 m         -2622443.163 m    0.001 m
Y:                -4247392.981 m    0.002 m         -4247391.673 m    0.002 m
Z:                 3956926.861 m    0.002 m          3956926.834 m    0.002 m
LAT:              38 35 28.05426    0.001 m       38 35 28.06670      0.001 m
E LON:           238 18 28.16354    0.001 m      238 18 28.10409      0.001 m
W LON:           121 41 31.83646    0.001 m      121 41 31.89591      0.001 m
EL HGT:                  -22.598 m  0.002 m              -23.122 m    0.002 m
ORTHO HGT:                 8.375 m  0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                  UTM COORDINATES    STATE PLANE COORDINATES
                   UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)       4272215.915 m        602665.922 m
EASTING (X)         613897.797 m       2026817.053 m
CONVERGENCE         0.81585354 deg      0.19407278 deg
POINT SCALE         0.99975975          0.99995154
COMBINED FACTOR     0.99976329          0.99995509

US NATIONAL GRID DESIGNATOR: 10SFH1389772215 (NAD 83)

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MARK:      p261 (p261 a  4)

REF FRAME:          NAD_83(2011) (2010.0000)                IGS08 (2014.6753)
X:                -2677432.147 m    0.001 m         -2677433.022 m    0.001 m
Y:                -4248807.523 m    0.002 m         -4248806.186 m    0.002 m
Z:                 3918882.060 m    0.002 m          3918882.053 m    0.002 m
LAT:              38 09 10.64359    0.001 m       38 09 10.65673      0.001 m
E LON:           237 46 56.91143    0.001 m      237 46 56.85175      0.001 m
W LON:           122 13 03.08857    0.001 m      122 13 03.14825      0.001 m
EL HGT:                  118.692 m  0.002 m              118.166 m    0.002 m
ORTHO HGT:               150.561 m  0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                  UTM COORDINATES    STATE PLANE COORDINATES
                   UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)       4223075.294 m        554005.247 m
EASTING (X)         568556.824 m       1980933.176 m
CONVERGENCE         0.48340313 deg     -0.13714237 deg
POINT SCALE         0.99965788          1.00004578
COMBINED FACTOR     0.99963926          1.00002716

US NATIONAL GRID DESIGNATOR: 10SEH6855623075 (NAD 83)
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APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK:      cho5 (cho5 a  2)

REF FRAME:          NAD_83(2011) (2010.0000)                  IGS08 (2014.6726)
X:                -2589569.372 m    0.001 m         -2589570.258 m    0.001 m
Y:                -4198613.275 m    0.002 m         -4198611.980 m    0.002 m
Z:                 4029540.481 m    0.002 m          4029540.456 m    0.002 m
LAT:             39 25 57.48598     0.001 m       39 25 57.49848      0.001 m
E LON:          238 20 06.18724     0.001 m      238 20 06.12729      0.001 m
W LON:          121 39 53.81276     0.001 m      121 39 53.87271      0.001 m
EL HGT:                 17.098 m    0.002 m               16.590 m    0.002 m
ORTHO HGT:              45.334 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)     4365638.688 m         696087.317 m
EASTING (X)       614899.215 m        2028844.773 m
CONVERGENCE       0.84807839 deg       0.21123968 deg
POINT SCALE       0.99976254           0.99993307
COMBINED FACTOR   0.99975986           0.99993039

US NATIONAL GRID DESIGNATOR: 10SFJ1489965638 (NAD 83)

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MARK:      cod1 (cod1    1)

REF FRAME:          NAD_83(2011) (2010.0000)                  IGS08 (2014.6751)
X:                -2619894.992 m    0.002 m         -2619895.875 m    0.002 m
Y:                -4248961.603 m    0.002 m         -4248960.295 m    0.002 m
Z:                 3956927.160 m    0.002 m          3956927.132 m    0.002 m
LAT:             38 35 28.11487     0.001 m       38 35 28.12732      0.001 m
E LON:          238 20 31.77700     0.001 m      238 20 31.71758      0.001 m
W LON:          121 39 28.22300     0.001 m      121 39 28.28242      0.001 m
EL HGT:                -24.460 m    0.002 m              -24.986 m    0.002 m
ORTHO HGT:               6.463 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)     4272260.928 m         602678.489 m
EASTING (X)       616888.293 m        2029808.422 m
CONVERGENCE       0.83727898 deg       0.21572122 deg
POINT SCALE       0.99976825           0.99995153
COMBINED FACTOR   0.99977209           0.99995537

US NATIONAL GRID DESIGNATOR: 10SFH1688872260 (NAD 83)
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APPENDIX B – OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK:      s300 (s300 a  3)

REF FRAME:         NAD_83(2011) (2010.0000)              IGS08 (2014.6726)
X:               -2645886.543 m    0.001 m        -2645887.420 m    0.001 m
Y:               -4307856.961 m    0.002 m        -4307855.641 m    0.002 m
Z:                3876512.196 m    0.002 m         3876512.164 m    0.002 m
LAT:            37 39 59.41374     0.001 m      37 39 59.42610      0.001 m
E LON:         238 26 30.28629     0.001 m     238 26 30.22763      0.001 m
W LON:         121 33 29.71371     0.001 m     121 33 29.77237      0.001 m
EL HGT:               496.304 m    0.002 m             495.757 m    0.002 m
ORTHO HGT:            528.063 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

               UTM COORDINATES    STATE PLANE COORDINATES
                UTM (Zone 10)        SPC (0403 CA 3)
NORTHING (Y)    4169791.690 m        629987.304 m
EASTING (X)      627155.978 m       1906640.117 m
CONVERGENCE      0.88111774 deg     -0.64789689 deg
POINT SCALE      0.99979915          0.99993026
COMBINED FACTOR  0.99972129          0.99985239

US NATIONAL GRID DESIGNATOR: 10SFG2715569791 (NAD 83)

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MARK:      sm08 (sm08    1)

REF FRAME:         NAD_83(2011) (2010.0000)              IGS08 (2014.6747)
X:               -2618019.472 m    0.001 m        -2618020.355 m    0.001 m
Y:               -4247940.539 m    0.002 m        -4247939.231 m    0.002 m
Z:                3959248.615 m    0.002 m         3959248.587 m    0.002 m
LAT:            38 37 04.45037     0.001 m      38 37 04.46284      0.001 m
E LON:         238 21 15.61592     0.001 m     238 21 15.55649      0.001 m
W LON:         121 38 44.38408     0.001 m     121 38 44.44351      0.001 m
EL HGT:               -24.366 m    0.002 m             -24.892 m    0.002 m
ORTHO HGT:              6.462 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

               UTM COORDINATES    STATE PLANE COORDINATES
                UTM (Zone 10)        SPC (0402 CA 2)
NORTHING (Y)    4275246.053 m        605652.939 m
EASTING (X)      617905.065 m       2030857.717 m
CONVERGENCE      0.84537168 deg      0.22339874 deg
POINT SCALE      0.99977119          0.99994765
COMBINED FACTOR  0.99977501          0.99995147

US NATIONAL GRID DESIGNATOR: 10SFH1790575246 (NAD 83)
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APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK: p271 (p271 a 3)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6747)	
X:	-2621689.337 m	0.001 m	-2621690.215 m	0.001 m
Y:	-4242469.113 m	0.002 m	-4242467.793 m	0.002 m
Z:	3962672.872 m	0.002 m	3962672.829 m	0.002 m
LAT:	38 39 26.44791	0.001 m	38 39 26.46021	0.001 m
E LON:	238 17 07.67390	0.001 m	238 17 07.61429	0.001 m
W LON:	121 42 52.32610	0.001 m	121 42 52.38571	0.001 m
EL HGT:	-17.798 m	0.002 m	-18.342 m	0.002 m
ORTHO HGT:	12.977 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 10)	SPC (0402 CA 2)
NORTHING (Y)	4279536.917 m	610010.159 m
EASTING (X)	611847.624 m	2024846.158 m
CONVERGENCE	0.80306366 deg	0.17997663 deg
POINT SCALE	0.99975405	0.99994232
COMBINED FACTOR	0.99975684	0.99994511

US NATIONAL GRID DESIGNATOR: 10SFH1184779536 (NAD 83)

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MARK: s16a (s16a 1)

REF FRAME:	NAD_83(2011) (2010.0000)		IGS08 (2014.6744)	
X:	-2615800.438 m	0.002 m	-2615801.321 m	0.002 m
Y:	-4244530.207 m	0.002 m	-4244528.900 m	0.002 m
Z:	3964338.733 m	0.002 m	3964338.706 m	0.002 m
LAT:	38 40 35.75313	0.001 m	38 40 35.76560	0.001 m
E LON:	238 21 19.74482	0.001 m	238 21 19.68534	0.001 m
W LON:	121 38 40.25518	0.001 m	121 38 40.31466	0.001 m
EL HGT:	-22.202 m	0.002 m	-22.726 m	0.002 m
ORTHO HGT:	8.450 m	0.022 m	(H = h - N WHERE N = GEOID12A HGT)	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 10)	SPC (0402 CA 2)
NORTHING (Y)	4281761.009 m	612168.595 m
EASTING (X)	617908.663 m	2030932.110 m
CONVERGENCE	0.84717221 deg	0.22412183 deg
POINT SCALE	0.99977120	0.99993988
COMBINED FACTOR	0.99977468	0.99994336

US NATIONAL GRID DESIGNATOR: 10SFH1790881761 (NAD 83)

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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CONSTRAINED MARKS
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MARK:       lnc2 (lnc2 a  2)
CONSTRAIN: 3-D NORMAL
ADJUST  X:   -0.007m (0.001m)   Y:   -0.008m (0.002m)   Z:    0.008m (0.002m)
ADJUST  N:   -0.000m (0.001m)   E:   -0.002m (0.001m)   H:    0.013m (0.001m)

REF FRAME:         NAD_83(2011) (2010.0000)                 IGS08 (2014.6744)
X:                -2587855.575 m    0.001 m        -2587856.456 m    0.001 m
Y:                -4247830.084 m    0.002 m        -4247828.780 m    0.002 m
Z:                 3979063.991 m    0.002 m         3979063.961 m    0.002 m
LAT:             38 50 47.41586     0.001 m      38 50 47.42845      0.001 m
E LON:          238 38 58.07306     0.001 m     238 38 58.01373      0.001 m
W LON:          121 21 01.92694     0.001 m     121 21 01.98627      0.001 m
EL HGT:                  6.394 m    0.001 m               5.865 m    0.001 m
ORTHO HGT:              36.400 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)      4301035.814 m       631169.703 m
EASTING (X)        643142.392 m      2056377.344 m
CONVERGENCE        1.03477945 deg     0.40946695 deg
POINT SCALE        0.99985231         0.99992327
COMBINED FACTOR    0.99985131         0.99992227

US NATIONAL GRID DESIGNATOR: 10SFJ4314201035 (NAD 83)

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MARK:       p267 (p267 a  1)
CONSTRAIN: 3-D NORMAL
ADJUST  X:    0.015m (0.001m)   Y:    0.010m (0.002m)   Z:   -0.003m (0.002m)
ADJUST  N:    0.008m (0.001m)   E:    0.007m (0.001m)   H:   -0.015m (0.001m)

REF FRAME:         NAD_83(2011) (2010.0000)                 IGS08 (2014.6741)
X:                -2639830.530 m    0.001 m        -2639831.415 m    0.001 m
Y:                -4253760.634 m    0.002 m        -4253759.322 m    0.002 m
Z:                 3938614.254 m    0.002 m         3938614.228 m    0.002 m
LAT:             38 22 49.19452     0.001 m      38 22 49.20691      0.001 m
E LON:          238 10 36.40911     0.001 m     238 10 36.34962      0.001 m
W LON:          121 49 23.59089     0.001 m     121 49 23.65038      0.001 m
EL HGT:                -16.983 m    0.001 m             -17.508 m    0.001 m
ORTHO HGT:              14.863 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)      4248670.398 m       579236.868 m
EASTING (X)        602783.963 m      2015446.347 m
CONVERGENCE        0.73070178 deg     0.11145439 deg
POINT SCALE        0.99973010         0.99998968
COMBINED FACTOR    0.99973276         0.99999234

US NATIONAL GRID DESIGNATOR: 10SFH0278348670 (NAD 83)
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APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK:      sm10 (sm10     1)

REF FRAME:          NAD_83(2011) (2010.0000)               IGS08 (2014.6754)
X:                -2618513.325 m    0.001 m        -2618514.209 m    0.001 m
Y:                -4245316.972 m    0.002 m        -4245315.665 m    0.002 m
Z:                 3961723.467 m    0.002 m         3961723.439 m    0.002 m
LAT:             38 38 47.11448     0.001 m      38 38 47.12692      0.001 m
E LON:          238 20 01.30834     0.001 m     238 20 01.24887      0.001 m
W LON:          121 39 58.69166     0.001 m     121 39 58.75113      0.001 m
EL HGT:                -21.329 m    0.002 m             -21.853 m    0.002 m
ORTHO HGT:               9.429 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                  UTM COORDINATES    STATE PLANE COORDINATES
                   UTM (Zone 10)        SPC (0402 CA 2)
NORTHING (Y)      4278384.382 m        608811.659 m
EASTING (X)        616062.043 m       2029048.568 m
CONVERGENCE        0.83300330 deg      0.21038524 deg
POINT SCALE        0.99976588          0.99994375
COMBINED FACTOR    0.99976923          0.99994710

US NATIONAL GRID DESIGNATOR: 10SFH1606278384 (NAD 83)

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MARK:      ucd1 (ucd1     1)

REF FRAME:          NAD_83(2011) (2010.0000)               IGS08 (2014.6744)
X:                -2628825.708 m    0.001 m        -2628826.591 m    0.001 m
Y:                -4247933.423 m    0.002 m        -4247932.114 m    0.002 m
Z:                 3952176.600 m    0.002 m         3952176.573 m    0.002 m
LAT:             38 32 10.44989     0.001 m      38 32 10.46230      0.001 m
E LON:          238 14 55.62017     0.001 m     238 14 55.56071      0.001 m
W LON:          121 45 04.37983     0.001 m     121 45 04.43929      0.001 m
EL HGT:                  0.014 m    0.001 m              -0.510 m    0.001 m
ORTHO HGT:              31.276 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                  UTM COORDINATES    STATE PLANE COORDINATES
                   UTM (Zone 10)        SPC (0402 CA 2)
NORTHING (Y)      4266053.262 m        596557.268 m
EASTING (X)        608838.628 m       2021690.295 m
CONVERGENCE        0.77808018 deg      0.15685004 deg
POINT SCALE        0.99974588          0.99996018
COMBINED FACTOR    0.99974588          0.99996018

US NATIONAL GRID DESIGNATOR: 10SFH0883866053 (NAD 83)
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APPENDIX C - MINIMALLY-CONSTRAINED GPS ADJUSTMENT REPORT

Project Information		**Coordinate System**	
Name:	C:\Projects\1037-001 \1037-001-201409.vce	Name:	US State Plane 1983
Size:	902 KB	Datum:	NAD 1983 (Conus)
Modified:	9/7/2014 5:44:03 PM (UTC:-7)	Zone:	California Zone 2 0402
Time zone:	Pacific Standard Time	Geoid:	GEOID12A
Reference number:		Vertical datum:	
Description:			

Network Adjustment Report

Adjustment Settings

Set-Up Errors

GNSS

Error in Height of Antenna: 0.000 m

Centering Error: 0.000 m

Covariance Display

Horizontal:

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 m

Scale on Linear Error [S]: 1.960

Three-Dimensional

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 m

Scale on Linear Error [S]: 1.960

Adjustment Statistics

Number of Iterations for Successful Adjustment: 2

Network Reference Factor: 1.00

Chi Square Test (95%): Passed

APPENDIX B - OPUS PROJECTS NETWORK ADJUSTMENT REPORT

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MARK:       p268 (p268 a  1)
CONSTRAIN: 3-D NORMAL
ADJUST  X:   -0.004m (0.001m)   Y:    0.015m (0.002m)   Z:   -0.007m (0.002m)
ADJUST  N:    0.001m (0.001m)   E:   -0.011m (0.001m)   H:   -0.013m (0.001m)

REF FRAME:        NAD_83(2011) (2010.0000)                  IGS08 (2014.6742)
X:               -2623314.307 m    0.001 m        -2623315.190 m    0.001 m
Y:               -4256409.676 m    0.002 m        -4256408.366 m    0.002 m
Z:                3946714.191 m    0.002 m         3946714.163 m    0.002 m
LAT:            38 28 24.68109     0.001 m      38 28 24.69352      0.001 m
E LON:         238 21 12.97215     0.001 m     238 21 12.91279      0.001 m
W LON:         121 38 47.02785     0.001 m     121 38 47.08721      0.001 m
EL HGT:               -23.431 m    0.001 m             -23.958 m    0.001 m
ORTHO HGT:              7.865 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)     4259223.306 m        589626.265 m
EASTING (X)       618077.039 m       2030856.122 m
CONVERGENCE       0.84224552 deg      0.22293573 deg
POINT SCALE       0.99977170          0.99997117
COMBINED FACTOR   0.99977538          0.99997485

US NATIONAL GRID DESIGNATOR: 10SFH1807759223 (NAD 83)

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MARK:       sacr (sacr a  1)
CONSTRAIN: 3-D NORMAL
ADJUST  X:    0.004m (0.001m)   Y:   -0.018m (0.002m)   Z:    0.009m (0.002m)
ADJUST  N:   -0.001m (0.001m)   E:    0.013m (0.001m)   H:    0.016m (0.002m)

REF FRAME:        NAD_83(2011) (2010.0000)                  IGS08 (2014.6727)
X:               -2595053.373 m    0.001 m        -2595054.254 m    0.001 m
Y:               -4259028.374 m    0.002 m        -4259027.067 m    0.002 m
Z:                3962484.552 m    0.002 m         3962484.523 m    0.002 m
LAT:            38 39 17.97126     0.001 m      38 39 17.98386      0.001 m
E LON:         238 38 44.80724     0.001 m     238 38 44.74800      0.001 m
W LON:         121 21 15.19276     0.001 m     121 21 15.25200      0.001 m
EL HGT:                 7.491 m    0.002 m               6.960 m    0.002 m
ORTHO HGT:             37.958 m    0.022 m  (H = h - N WHERE N = GEOID12A HGT)

                UTM COORDINATES    STATE PLANE COORDINATES
                 UTM (Zone 10)         SPC (0402 CA 2)
NORTHING (Y)     4279776.701 m        609909.476 m
EASTING (X)       643204.819 m       2056208.536 m
CONVERGENCE       1.02817703 deg      0.40714371 deg
POINT SCALE       0.99985254          0.99994262
COMBINED FACTOR   0.99985136          0.99994144

US NATIONAL GRID DESIGNATOR: 10SFH4320479776 (NAD 83)
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ID	(Meter)	(Meter)	(Meter)	(Meter)	(Meter)	(Meter)	
1031	2025278.783	0.002	612222.692	0.002	9.603	0.012	
CAST	2031038.789	0.002	599682.330	0.003	4.670	0.015	
COD1	2029806.978	0.002	602678.863	0.002	5.965	0.013	
COY1	2026815.610	0.002	602666.297	0.002	7.865	0.011	
CR27	2026470.851	0.002	605718.258	0.002	8.521	0.019	
P268	2030854.677	0.003	589626.646	0.002	7.335	0.011	
P271	2024844.715	?	610010.534	?	12.433	?	LLh
RIVE	2037234.834	0.004	608949.583	0.004	11.464	0.026	
S16A	2030930.667	0.002	612168.968	0.002	7.933	0.013	
SM08	2030856.272	0.002	605653.314	0.002	5.959	0.010	
SM09	2034075.188	0.003	605988.111	0.003	5.125	0.017	
SM10	2029047.124	0.002	608812.032	0.002	8.913	0.008	
SM11	2028520.190	0.002	611638.181	0.002	6.534	0.013	
UCD1	2021688.853	0.002	596557.647	0.001	30.744	0.008	

Adjusted Geodetic Coordinates

Point ID	Latitude	Longitude	Height (Meter)	Height Error (Meter)	Constraint
1031	N38°40'38.15923"	W121°42'34.13964"	-21.096	0.012	
CAST	N38°33'50.79156"	W121°38'37.86615"	-26.319	0.015	
COD1	N38°35'28.12719"	W121°39'28.28263"	-24.958	0.013	

Precision Confidence Level: 95%
Degrees of Freedom: 141

Post Processed Vector Statistics

Reference Factor: 1.00
Redundancy Number: 141.00
A Priori Scalar: 1.57

Control Coordinate Comparisons

Values shown are control coordinates minus adjusted coordinates.

Point ID	ΔEasting (Meter)	ΔNorthing (Meter)	ΔElevation (Meter)	ΔHeight (Meter)
1031	0.003	0.007	?	-0.012
COD1	0.005	0.004	?	-0.028
COY1	0.003	0.004	?	-0.014
S16A	0.004	0.006	?	-0.007
SM08	0.006	0.004	?	-0.023
SM10	0.004	0.006	?	-0.008
UCD1	0.000	0.000	?	0.008

Control Point Constraints

Point ID	Type	East σ (Meter)	North σ (Meter)	Height σ (Meter)	Elevation σ (Meter)
P271	Global	Fixed	Fixed	Fixed	
Fixed = 0.000001(Meter)					

Adjusted Grid Coordinates

Point	Easting	Easting Error	Northing	Northing Error	Elevation	Elevation Error	Constraint

Error Ellipse Components

Point ID	Semi-major axis (Meter)	Semi-minor axis (Meter)	Azimuth
1031	0.003	0.002	2°
CAST	0.003	0.003	25°
COD1	0.003	0.003	46°
COY1	0.003	0.002	54°
CR27	0.003	0.003	50°
P268	0.004	0.002	85°
RIVE	0.006	0.004	50°
S16A	0.003	0.003	9°
SM08	0.003	0.002	49°
SM09	0.004	0.003	40°
SM10	0.002	0.002	29°
SM11	0.003	0.002	180°
UCD1	0.002	0.002	84°

Adjusted GPS Observations

Observation ID		Observation	A-posteriori Error	Residual	Standardized Residual
P271 --> SM10 (PV45)	Az.	106°05'53"	0.078 sec	-0.053 sec	-0.374
	ΔHt.	-3.503 m	0.008 m	-0.036 m	-4.824
	Ellip Dist.	4370.220 m	0.002 m	0.002 m	1.044
SM10 --> SM08 (PV22)	Az.	150°24'31"	0.099 sec	0.127 sec	1.269
	ΔHt.	-3.024 m	0.009 m	-0.034 m	-4.145
	Ellip Dist.	3640.323 m	0.002 m	0.001 m	0.248
SM08 --> COY1 (PV11)	Az.	233°45'00"	0.068 sec	-0.037 sec	-0.480
	ΔHt.	1.761 m	0.011 m	-0.032 m	-2.774
	Ellip Dist.	5025.113 m	0.002 m	0.003 m	1.025
SM10 --> SM08 (PV74)	Az.	150°24'31"	0.099 sec	-0.109 sec	-0.907
	ΔHt.	-3.024 m	0.009 m	0.015 m	2.002

COY1	N38°35'28.06656"	W121°41'31.89604"	-23.108	0.011	
CR27	N38°37'07.08407"	W121°41'45.72062"	-22.363	0.019	
P268	N38°28'24.69364"	W121°38'47.08739"	-23.961	0.011	
P271	N38°39'26.46021"	W121°42'52.38571"	-18.342	?	LLh
RIVE	N38°38'50.47531"	W121°34'20.12486"	-19.269	0.026	
S16A	N38°40'35.76543"	W121°38'40.31483"	-22.719	0.013	
SM08	N38°37'04.46272"	W121°38'44.44375"	-24.869	0.010	
SM09	N38°37'14.89242"	W121°36'31.32010"	-25.676	0.017	
SM10	N38°38'47.12675"	W121°39'58.75130"	-21.845	0.008	
SM11	N38°40'18.84508"	W121°40'20.12109"	-24.146	0.013	
UCD1	N38°32'10.46230"	W121°45'04.43930"	-0.518	0.008	

Adjusted ECEF Coordinates

Point ID	X (Meter)	X Error (Meter)	Y (Meter)	Y Error (Meter)	Z (Meter)	Z Error (Meter)	3D Error (Meter)	Constraint
1031	-2620587.728	0.005	-4241522.703	0.008	3964397.346	0.008	0.013	
CAST	-2619838.599	0.007	-4251192.973	0.010	3954579.934	0.009	0.015	
COD1	-2619895.892	0.006	-4248960.313	0.009	3956927.146	0.009	0.014	
COY1	-2622443.173	0.005	-4247391.683	0.008	3956926.840	0.007	0.011	
CR27	-2621727.204	0.008	-4245595.486	0.013	3959313.317	0.012	0.019	
P268	-2623315.192	0.005	-4256408.360	0.008	3946714.164	0.007	0.012	
P271	-2621690.215	?	-4242467.792	?	3962672.829	?	?	LLh
RIVE	-2611508.416	0.011	-4249555.556	0.018	3961805.692	0.017	0.027	
S16A	-2615801.329	0.006	-4244528.905	0.009	3964338.705	0.009	0.014	
SM08	-2618020.370	0.005	-4247939.245	0.007	3959248.599	0.007	0.011	
SM09	-2615172.663	0.007	-4249456.549	0.011	3959499.368	0.011	0.017	
SM10	-2618514.217	0.004	-4245315.671	0.006	3961723.440	0.005	0.009	
SM11	-2618025.447	0.006	-4243539.221	0.008	3963930.476	0.008	0.013	
UCD1	-2628826.589	0.004	-4247932.109	0.005	3952176.568	0.005	0.008	

	ΔHt.	-3.024 m	0.009 m	-0.014 m	-1.617
	Ellip Dist.	3640.323 m	0.002 m	-0.002 m	-1.329
COY1 --> CR27 (PV59)	**Az.**	353°44'57"	0.164 sec	0.004 sec	0.029
	ΔHt.	0.744 m	0.018 m	0.012 m	0.620
	Ellip Dist.	3071.527 m	0.002 m	0.003 m	1.598
P271 --> 1031 (PV55)	**Az.**	11°16'53"	0.158 sec	-0.053 sec	-0.584
	ΔHt.	-2.754 m	0.012 m	0.016 m	1.588
	Ellip Dist.	2254.475 m	0.002 m	-0.001 m	-0.381
UCD1 --> P268 (PV123)	**Az.**	127°15'11"	0.033 sec	-0.004 sec	-0.207
	ΔHt.	-23.443 m	0.009 m	0.008 m	1.587
	Ellip Dist.	11491.744 m	0.002 m	0.000 m	0.300
S16A --> RIVE (PV61)	**Az.**	117°16'36"	0.122 sec	0.156 sec	1.374
	ΔHt.	3.451 m	0.025 m	-0.025 m	-1.137
	Ellip Dist.	7079.040 m	0.003 m	-0.006 m	-1.578
P271 --> SM11 (PV44)	**Az.**	66°17'40"	0.111 sec	-0.016 sec	-0.112
	ΔHt.	-5.804 m	0.013 m	0.031 m	1.566
	Ellip Dist.	4019.980 m	0.002 m	-0.002 m	-0.650
UCD1 --> CAST (PV41)	**Az.**	71°40'41"	0.050 sec	-0.016 sec	-0.298
	ΔHt.	-25.801 m	0.015 m	0.004 m	0.209
	Ellip Dist.	9858.657 m	0.002 m	0.005 m	1.543
SM08 --> CAST (PV13)	**Az.**	178°28'21"	0.075 sec	-0.006 sec	-0.057
	ΔHt.	-1.450 m	0.014 m	-0.026 m	-1.526
	Ellip Dist.	5974.062 m	0.002 m	0.003 m	0.939
COY1 --> CR27 (PV4)	**Az.**	353°44'57"	0.164 sec	-0.143 sec	-0.655
	ΔHt.	0.744 m	0.018 m	-0.029 m	-1.482
	Ellip Dist.	3071.527 m	0.002 m	0.001 m	0.443
SM08 --> CR27 (PV10)	**Az.**	271°04'18"	0.110 sec	-0.249 sec	-1.445
	ΔHt.	2.506 m	0.018 m	-0.007 m	-0.153
	Ellip Dist.	4386.131 m	0.002 m	0.001 m	0.225
UCD1 --> COY1 (PV39)	**Az.**	40°09'45"	0.051 sec	0.008 sec	0.151
	ΔHt.	-22.590 m	0.012 m	-0.002 m	-0.147
	Ellip Dist.	7975.266 m	0.002 m	0.005 m	1.418

	Ellip Dist.	3640.323 m	0.002 m	0.003 m	2.619
P271 --> SM10 (PV46)	**Az.**	106°05'53"	0.078 sec	-0.039 sec	-0.401
	ΔHt.	-3.503 m	0.008 m	-0.022 m	-2.389
	Ellip Dist.	4370.220 m	0.002 m	0.000 m	0.025
P271 --> SM10 (PV87)	**Az.**	106°05'53"	0.078 sec	0.052 sec	0.774
	ΔHt.	-3.503 m	0.008 m	0.018 m	2.326
	Ellip Dist.	4370.220 m	0.002 m	0.001 m	0.429
SM10 --> S16A (PV19)	**Az.**	29°30'24"	0.104 sec	-0.019 sec	-0.200
	ΔHt.	-0.874 m	0.012 m	-0.022 m	-2.170
	Ellip Dist.	3849.477 m	0.002 m	0.001 m	0.548
UCD1 --> CAST (PV107)	**Az.**	71°40'41"	0.050 sec	-0.075 sec	-0.914
	ΔHt.	-25.801 m	0.015 m	0.033 m	1.287
	Ellip Dist.	9858.657 m	0.002 m	-0.006 m	-2.101
COY1 --> CAST (PV3)	**Az.**	125°26'17"	0.096 sec	-0.018 sec	-0.152
	ΔHt.	-3.211 m	0.014 m	-0.022 m	-1.334
	Ellip Dist.	5171.245 m	0.002 m	0.006 m	2.021
UCD1 --> P271 (PV97)	**Az.**	13°21'33"	0.029 sec	-0.007 sec	-0.349
	ΔHt.	-17.824 m	0.008 m	-0.009 m	-1.988
	Ellip Dist.	13818.769 m	0.001 m	0.000 m	-0.446
S16A --> 1031 (PV62)	**Az.**	270°46'07"	0.098 sec	-0.004 sec	-0.032
	ΔHt.	1.624 m	0.015 m	-0.033 m	-1.938
	Ellip Dist.	5652.479 m	0.002 m	-0.002 m	-0.696
P271 --> COY1 (PV93)	**Az.**	165°09'29"	0.059 sec	0.032 sec	0.378
	ΔHt.	-4.766 m	0.011 m	0.028 m	1.795
	Ellip Dist.	7604.498 m	0.002 m	0.000 m	-0.158
UCD1 --> COY1 (PV105)	**Az.**	40°09'45"	0.051 sec	-0.013 sec	-0.201
	ΔHt.	-22.590 m	0.012 m	0.027 m	1.735
	Ellip Dist.	7975.266 m	0.002 m	0.001 m	0.335
P268 --> CAST (PV120)	**Az.**	1°16'19"	0.057 sec	0.003 sec	0.054
	ΔHt.	-2.358 m	0.016 m	0.045 m	1.701
	Ellip Dist.	10057.739 m	0.003 m	-0.003 m	-0.666
SM10 --> SM08 (PV18)	**Az.**	150°24'31"	0.099 sec	-0.085 sec	-0.981

	Ellip Dist.	2468.373 m	0.002 m	0.000 m	0.174
COY1 --> COD1 (PV57)	**Az.**	89°57'13"	0.136 sec	-0.029 sec	-0.253
	ΔHt.	-1.851 m	0.011 m	-0.009 m	-0.962
	Ellip Dist.	2991.539 m	0.002 m	0.001 m	0.394
SM08 --> SM09 (PV15)	**Az.**	84°17'08"	0.189 sec	0.019 sec	0.142
	ΔHt.	-0.807 m	0.014 m	0.022 m	0.961
	Ellip Dist.	3236.451 m	0.003 m	0.000 m	0.156
1031 --> SM11 (PV85)	**Az.**	100°24'19"	0.152 sec	0.045 sec	0.286
	ΔHt.	-3.051 m	0.014 m	-0.011 m	-0.920
	Ellip Dist.	3293.883 m	0.002 m	0.000 m	0.104
SM08 --> COD1 (PV12)	**Az.**	199°39'17"	0.117 sec	0.077 sec	0.919
	ΔHt.	-0.089 m	0.012 m	0.002 m	0.224
	Ellip Dist.	3154.264 m	0.002 m	0.001 m	0.775
COD1 --> CAST (PV1)	**Az.**	157°52'09"	0.142 sec	-0.073 sec	-0.541
	ΔHt.	-1.361 m	0.014 m	0.008 m	0.454
	Ellip Dist.	3239.991 m	0.002 m	0.002 m	0.901
SM10 --> SM11 (PV27)	**Az.**	349°38'56"	0.129 sec	0.026 sec	0.216
	ΔHt.	-2.301 m	0.012 m	0.014 m	0.889
	Ellip Dist.	2875.019 m	0.002 m	-0.002 m	-0.731
SM08 --> CR27 (PV65)	**Az.**	271°04'18"	0.110 sec	0.001 sec	0.006
	ΔHt.	2.506 m	0.018 m	-0.017 m	-0.872
	Ellip Dist.	4386.131 m	0.002 m	-0.002 m	-0.873
SM08 --> CAST (PV68)	**Az.**	178°28'21"	0.075 sec	0.018 sec	0.212
	ΔHt.	-1.450 m	0.014 m	0.002 m	0.075
	Ellip Dist.	5974.062 m	0.002 m	-0.003 m	-0.834
1031 --> SM11 (PV30)	**Az.**	100°24'19"	0.152 sec	-0.014 sec	-0.092
	ΔHt.	-3.051 m	0.014 m	0.014 m	0.826
	Ellip Dist.	3293.883 m	0.002 m	0.000 m	-0.263
S16A --> RIVE (PV6)	**Az.**	117°16'36"	0.122 sec	-0.019 sec	-0.158
	ΔHt.	3.451 m	0.025 m	0.023 m	0.787
	Ellip Dist.	7079.040 m	0.003 m	-0.002 m	-0.817
S16A --> 1031 (PV7)	**Az.**	270°46'07"	0.098 sec	-0.008 sec	-0.061

SM09 --> RIVE (PV17)	**Az.**	47°06'04"	0.132 sec	0.046 sec	0.457
	ΔHt.	6.408 m	0.024 m	-0.007 m	-0.274
	Ellip Dist.	4330.789 m	0.004 m	0.004 m	1.389
COD1 --> CAST (PV56)	**Az.**	157°52'09"	0.142 sec	0.002 sec	0.018
	ΔHt.	-1.361 m	0.014 m	-0.017 m	-1.304
	Ellip Dist.	3239.991 m	0.002 m	-0.001 m	-0.553
COY1 --> COD1 (PV2)	**Az.**	89°57'13"	0.136 sec	-0.045 sec	-0.383
	ΔHt.	-1.851 m	0.011 m	0.013 m	1.281
	Ellip Dist.	2991.539 m	0.002 m	0.001 m	0.775
SM08 --> COD1 (PV67)	**Az.**	199°39'17"	0.117 sec	-0.079 sec	-0.702
	ΔHt.	-0.089 m	0.012 m	-0.011 m	-1.172
	Ellip Dist.	3154.264 m	0.002 m	-0.001 m	-0.642
SM10 --> SM11 (PV82)	**Az.**	349°38'56"	0.129 sec	0.036 sec	0.260
	ΔHt.	-2.301 m	0.012 m	-0.014 m	-1.135
	Ellip Dist.	2875.019 m	0.002 m	0.000 m	-0.059
S16A --> SM09 (PV16)	**Az.**	153°15'34"	0.098 sec	0.001 sec	0.010
	ΔHt.	-2.957 m	0.018 m	-0.024 m	-1.129
	Ellip Dist.	6935.160 m	0.003 m	-0.001 m	-0.472
UCD1 --> P268 (PV109)	**Az.**	127°15'11"	0.033 sec	0.002 sec	0.091
	ΔHt.	-23.443 m	0.009 m	-0.005 m	-1.077
	Ellip Dist.	11491.744 m	0.002 m	0.000 m	0.244
SM10 --> S16A (PV75)	**Az.**	29°30'24"	0.104 sec	-0.012 sec	-0.115
	ΔHt.	-0.874 m	0.012 m	0.002 m	0.171
	Ellip Dist.	3849.477 m	0.002 m	0.003 m	1.030
SM10 --> CR27 (PV77)	**Az.**	219°59'43"	0.117 sec	-0.013 sec	-0.119
	ΔHt.	-0.518 m	0.019 m	0.022 m	0.977
	Ellip Dist.	4026.212 m	0.003 m	-0.001 m	-0.399
COY1 --> CAST (PV58)	**Az.**	125°26'17"	0.096 sec	0.010 sec	0.080
	ΔHt.	-3.211 m	0.014 m	0.011 m	0.474
	Ellip Dist.	5171.245 m	0.002 m	-0.003 m	-0.970
S16A --> SM11 (PV84)	**Az.**	257°48'20"	0.191 sec	0.025 sec	0.146
	ΔHt.	-1.427 m	0.013 m	-0.011 m	-0.963

P271 --> COY1 (PV52)	**Az.**	165°09'29"	0.059 sec	-0.031 sec	-0.376
	ΔHt.	-4.766 m	0.011 m	0.001 m	0.099
	Ellip Dist.	7604.498 m	0.002 m	0.000 m	0.028
P271 --> CR27 (PV92)	**Az.**	159°25'51"	0.110 sec	0.016 sec	0.175
	ΔHt.	-4.021 m	0.019 m	0.002 m	0.131
	Ellip Dist.	4590.237 m	0.002 m	0.001 m	0.260
SM10 --> SM09 (PV73)	**Az.**	119°31'50"	0.120 sec	0.007 sec	0.034
	ΔHt.	-3.831 m	0.016 m	0.002 m	0.043
	Ellip Dist.	5767.112 m	0.003 m	0.001 m	0.095

Covariance Terms

From Point	To Point		Components	A-posteriori Error	Horiz. Precision (Ratio)	3D Precision (Ratio)
1031	P271	**Az.**	191°17'05"	0.157 sec	1 : 1057493	1 : 1057519
		ΔHt.	2.754 m	0.012 m		
		ΔElev.	2.830 m	0.012 m		
		Ellip Dist.	2254.475 m	0.002 m		
1031	S16A	**Az.**	90°43'41"	0.098 sec	1 : 2552733	1 : 2552187
		ΔHt.	-1.624 m	0.015 m		
		ΔElev.	-1.670 m	0.015 m		
		Ellip Dist.	5652.479 m	0.002 m		
1031	SM11	**Az.**	100°24'19"	0.153 sec	1 : 1653677	1 : 1651496
		ΔHt.	-3.051 m	0.014 m		
		ΔElev.	-3.069 m	0.014 m		
		Ellip Dist.	3293.883 m	0.002 m		
CAST	COD1	**Az.**	337°52'41"	0.142 sec	1 : 1340853	1 : 1339734
		ΔHt.	1.361 m	0.014 m		
		ΔElev.	1.294 m	0.014 m		
		Ellip Dist.	3239.991 m	0.002 m		
CAST	COY1	**Az.**	305°28'06"	0.096 sec	1 : 2395191	1 : 2392920
		ΔHt.	3.211 m	0.014 m		

	ΔHt.	1.624 m	0.015 m	-0.003 m	-0.119
	Ellip Dist.	5652.479 m	0.002 m	-0.002 m	-0.694
SM08 --> SM09 (PV70)	Az.	84°17'08"	0.189 sec	0.077 sec	0.364
	ΔHt.	-0.807 m	0.014 m	-0.001 m	-0.228
	Ellip Dist.	3236.451 m	0.003 m	0.002 m	0.693
P271 --> CR27 (PV51)	Az.	159°25'51"	0.110 sec	-0.014 sec	-0.067
	ΔHt.	-4.021 m	0.019 m	0.031 m	0.690
	Ellip Dist.	4590.237 m	0.002 m	0.001 m	0.213
P271 --> SM11 (PV86)	Az.	66°17'40"	0.111 sec	0.032 sec	0.211
	ΔHt.	-5.804 m	0.013 m	0.002 m	0.171
	Ellip Dist.	4019.980 m	0.002 m	-0.002 m	-0.657
UCD1 --> P271 (PV43)	Az.	13°21'33"	0.029 sec	0.004 sec	0.211
	ΔHt.	-17.824 m	0.008 m	0.003 m	0.608
	Ellip Dist.	13818.769 m	0.001 m	0.000 m	-0.437
SM08 --> COY1 (PV66)	Az.	233°45'00"	0.068 sec	-0.037 sec	-0.435
	ΔHt.	1.761 m	0.011 m	-0.006 m	-0.410
	Ellip Dist.	5025.113 m	0.002 m	-0.002 m	-0.583
SM09 --> RIVE (PV72)	Az.	47°06'04"	0.132 sec	0.047 sec	0.561
	ΔHt.	6.408 m	0.024 m	-0.005 m	-0.373
	Ellip Dist.	4330.789 m	0.004 m	-0.002 m	-0.560
S16A --> SM11 (PV29)	Az.	257°48'20"	0.191 sec	-0.032 sec	-0.195
	ΔHt.	-1.427 m	0.013 m	0.007 m	0.493
	Ellip Dist.	2468.373 m	0.002 m	-0.001 m	-0.382
P268 --> CAST (PV134)	Az.	1°16'19"	0.057 sec	0.030 sec	0.472
	ΔHt.	-2.358 m	0.016 m	-0.004 m	-0.218
	Ellip Dist.	10057.739 m	0.003 m	-0.001 m	-0.245
P271 --> 1031 (PV96)	Az.	11°16'53"	0.158 sec	-0.024 sec	-0.182
	ΔHt.	-2.754 m	0.012 m	-0.003 m	-0.349
	Ellip Dist.	2254.475 m	0.002 m	-0.001 m	-0.446
S16A --> SM09 (PV71)	Az.	153°15'34"	0.098 sec	0.091 sec	0.391
	ΔHt.	-2.957 m	0.018 m	-0.006 m	-0.122
	Ellip Dist.	6935.160 m	0.003 m	0.001 m	0.189

COY1	UCD1	**Az.**	220°11'58"	0.051 sec	1 : 3412861	1 : 3411619
		ΔHt.	22.590 m	0.012 m		
		ΔElev.	22.879 m	0.012 m		
		Ellip Dist.	7975.266 m	0.002 m		
CR27	P271	**Az.**	339°26'32"	0.110 sec	1 : 2014188	1 : 2015173
		ΔHt.	4.021 m	0.019 m		
		ΔElev.	3.912 m	0.019 m		
		Ellip Dist.	4590.237 m	0.002 m		
CR27	SM08	**Az.**	91°02'25"	0.110 sec	1 : 1837654	1 : 1839212
		ΔHt.	-2.506 m	0.018 m		
		ΔElev.	-2.562 m	0.018 m		
		Ellip Dist.	4386.131 m	0.002 m		
CR27	SM10	**Az.**	39°58'37"	0.117 sec	1 : 1578617	1 : 1578491
		ΔHt.	0.518 m	0.019 m		
		ΔElev.	0.392 m	0.019 m		
		Ellip Dist.	4026.212 m	0.003 m		
RIVE	S16A	**Az.**	297°19'18"	0.122 sec	1 : 2116031	1 : 2118405
		ΔHt.	-3.451 m	0.025 m		
		ΔElev.	-3.532 m	0.025 m		
		Ellip Dist.	7079.040 m	0.003 m		
RIVE	SM09	**Az.**	227°07'26"	0.132 sec	1 : 1055317	1 : 1054019
		ΔHt.	-6.408 m	0.024 m		
		ΔElev.	-6.339 m	0.024 m		
		Ellip Dist.	4330.789 m	0.004 m		
S16A	SM09	**Az.**	153°15'34"	0.098 sec	1 : 2574971	1 : 2573056
		ΔHt.	-2.957 m	0.018 m		
		ΔElev.	-2.807 m	0.018 m		
		Ellip Dist.	6935.160 m	0.003 m		
S16A	SM10	**Az.**	209°31'13"	0.103 sec	1 : 1726658	1 : 1727353
		ΔHt.	0.874 m	0.012 m		
		ΔElev.	0.980 m	0.012 m		
		Ellip Dist.	3849.477 m	0.002 m		
S16A	SM11	**Az.**	257°48'20"	0.191 sec	1 : 1312698	1 : 1313696
		ΔHt.	-1.427 m	0.013 m		

		ΔElev.	3.195 m	0.014 m		
		Ellip Dist.	5171.245 m	0.002 m		
CAST	P268	**Az.**	181°16'24"	0.057 sec	1 : 3773990	1 : 3772785
		ΔHt.	2.358 m	0.016 m		
		ΔElev.	2.665 m	0.016 m		
		Ellip Dist.	10057.739 m	0.003 m		
CAST	SM08	**Az.**	358°28'25"	0.075 sec	1 : 2408874	1 : 2408166
		ΔHt.	1.450 m	0.014 m		
		ΔElev.	1.289 m	0.014 m		
		Ellip Dist.	5974.062 m	0.002 m		
CAST	UCD1	**Az.**	251°44'42"	0.050 sec	1 : 4123090	1 : 4118443
		ΔHt.	25.801 m	0.015 m		
		ΔElev.	26.074 m	0.015 m		
		Ellip Dist.	9858.657 m	0.002 m		
COD1	COY1	**Az.**	269°58'30"	0.136 sec	1 : 1527228	1 : 1528903
		ΔHt.	1.851 m	0.011 m		
		ΔElev.	1.901 m	0.011 m		
		Ellip Dist.	2991.539 m	0.002 m		
COD1	SM08	**Az.**	19°38'49"	0.116 sec	1 : 1461741	1 : 1460875
		ΔHt.	0.089 m	0.012 m		
		ΔElev.	-0.006 m	0.012 m		
		Ellip Dist.	3154.264 m	0.002 m		
COY1	CR27	**Az.**	353°44'57"	0.163 sec	1 : 1317734	1 : 1317312
		ΔHt.	0.744 m	0.018 m		
		ΔElev.	0.656 m	0.018 m		
		Ellip Dist.	3071.527 m	0.002 m		
COY1	P271	**Az.**	345°10'19"	0.059 sec	1 : 4083332	1 : 4081238
		ΔHt.	4.766 m	0.011 m		
		ΔElev.	4.568 m	0.011 m		
		Ellip Dist.	7604.498 m	0.002 m		
COY1	SM08	**Az.**	53°43'15"	0.068 sec	1 : 2385709	1 : 2386218
		ΔHt.	-1.761 m	0.011 m		
		ΔElev.	-1.906 m	0.011 m		
		Ellip Dist.	5025.113 m	0.002 m		

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		ΔElev.	-1.399 m	0.013 m		
		Ellip Dist.	2468.373 m	0.002 m		
SM08	SM09	**Az.**	84°17'08"	0.189 sec	1 : 1086141	1 : 1087567
		ΔHt.	-0.807 m	0.014 m		
		ΔElev.	-0.834 m	0.014 m		
		Ellip Dist.	3236.451 m	0.003 m		
SM08	SM10	**Az.**	330°25'17"	0.099 sec	1 : 2290748	1 : 2290777
		ΔHt.	3.024 m	0.009 m		
		ΔElev.	2.954 m	0.009 m		
		Ellip Dist.	3640.323 m	0.002 m		
SM09	SM10	**Az.**	299°33'59"	0.120 sec	1 : 2173531	1 : 2175731
		ΔHt.	3.831 m	0.016 m		
		ΔElev.	3.787 m	0.016 m		
		Ellip Dist.	5767.112 m	0.003 m		
SM10	P271	**Az.**	286°07'41"	0.078 sec	1 : 2798098	1 : 2798632
		ΔHt.	3.503 m	0.008 m		
		ΔElev.	3.520 m	0.008 m		
		Ellip Dist.	4370.220 m	0.002 m		
SM10	SM11	**Az.**	349°38'56"	0.129 sec	1 : 1335421	1 : 1335663
		ΔHt.	-2.301 m	0.012 m		
		ΔElev.	-2.379 m	0.012 m		
		Ellip Dist.	2875.019 m	0.002 m		
SM11	P271	**Az.**	246°19'15"	0.111 sec	1 : 2111126	1 : 2110872
		ΔHt.	5.804 m	0.013 m		
		ΔElev.	5.899 m	0.013 m		
		Ellip Dist.	4019.980 m	0.002 m		
UCD1	P268	**Az.**	127°15'11"	0.033 sec	1 : 5969252	1 : 5977614
		ΔHt.	-23.443 m	0.009 m		
		ΔElev.	-23.409 m	0.009 m		
		Ellip Dist.	11491.744 m	0.002 m		
UCD1	P271	**Az.**	13°21'33"	0.029 sec	1 : 9593411	1 : 9578680
		ΔHt.	-17.824 m	0.008 m		
		ΔElev.	-18.311 m	0.008 m		
		Ellip Dist.	13818.769 m	0.001 m		

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Summary of Unadjusted Input Observations

Number of Entered Stations (Meters) = 10
(Elevations Marked with (*) are Ellipsoid Heights)

Partially Fixed	N StdErr	E StdErr	Elev StdErr	Description
15	608777.2764 0.0100	2029032.5965 0.0100	10.8178 FREE	CONTROL
16 MARK	608797.8742 FREE	2028884.0119 FREE	10.0000 FIXED	CONTROL AZ

Partially Fixed	Latitude N-StdErr	Longitude E-StdErr	Elev StdErr	Description
UCD1	38-32-10.449890 0.0010	121-45-04.379830 0.0010	0.0140* 0.0010	UCD1
P268	38-28-24.681090 0.0010	121-38-47.027850 0.0010	-23.4310* 0.0010	P268
P271	38-39-26.447910 0.0010	121-42-52.326100 0.0010	-17.7980* 0.0020	P271
COD1	38-35-28.114870 0.0010	121-39-28.223000 0.0010	-24.4600* 0.0020	COD1
COY1	38-35-28.054260 0.0010	121-41-31.836460 0.0010	-22.5980* 0.0020	COY1
S16A	38-40-35.753130 0.0010	121-38-40.255180 0.0010	-22.2020* 0.0020	S16A
SM08	38-37-04.450370 0.0010	121-38-44.384080 0.0010	-24.3660* 0.0020	SM08
SM10	38-38-47.114480 0.0010	121-39-58.691660 0.0010	-21.3290* 0.0020	SM10

Number of Measured Angle Observations (DMS) = 2

From	At	To	Angle	StdErr	t-T
16	15	EX11	0-00-01.00	4.76	-0.00
16	15	SM10	107-06-31.00	12.67	-0.02

Number of Measured Distance Observations (Meters) = 3

From	To	Distance	StdErr	HI	HT	Comb Grid	Type
15	16	121.9202	FIXED	0.000	0.000	0.9999470	S
15	EX11	89.6510	0.0031	1.524	2.121	0.9999472	S
15	SM10	37.9205	0.0030	1.524	2.121	0.9999470	S

Number of Zenith Observations (DMS) = 2

From	To	Zenith	StdErr	HI	HT
15	EX11	91-45-28.00	5.35	1.524	2.121
15	SM10	91-11-33.00	11.89	1.524	2.121

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Note: In order to effectively incorporate the trigonometric leveling data, approximate positions for the instrument and backsight stations were determined in order to provide the adjustment engine with adequate seed data. This pertains to stations 15 and 16 referenced in the adjustment report. These station were ephemeral and are not marked on the ground.

Summary of Files Used and Option Settings

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Project Folder and Data Files

Project Name		1037-001-201409
Project Folder		C:\STAR
Data File List	1.	1037-001-201409.dat
	2.	1037-001-201409.gps

Project Option Settings

STAR*NET Run Mode	: Adjust with Error Propagation
Type of Adjustment	: 3D
Project Units	: Meters; DMS
Coordinate System	: Lambert NAD83; CA Zone 2 0402
Geoid Height Model	: GEOID12A-5.GHT
Longitude Sign Convention	: Positive West
Input/Output Coordinate Order	: North-East
Angle Data Station Order	: From-At-To
Distance/Vertical Data Type	: Slope/Zenith
Convergence Limit; Max Iterations	: 0.010000; 99
Default Coefficient of Refraction	: 0.070000
Create Coordinate File	: Yes
Create Geodetic Position File	: Yes
Create Ground Scale Coordinate File	: No
Create Dump File	: No
GPS Vector Standard Error Factors	: 1.9600
GPS Vector Centering (Meters)	: 0.00100
GPS Vector Transformations	: None

Company Library Instrument TCRA1102
Note: Leica TCRA1102plus Robot

Distances (Constant)	:	0.002012 Meters
Distances (PPM)	:	2.000000
Angles	:	2.000000 Seconds
Directions	:	2.000000 Seconds
Azimuths & Bearings	:	2.000000 Seconds
Zeniths	:	2.000000 Seconds
Elevation Differences (Constant)	:	0.001524 Meters
Elevation Differences (PPM)	:	0.000000
Differential Levels	:	0.002403 Meters / Km
Centering Error Instrument	:	0.001524 Meters
Centering Error Target	:	0.001524 Meters
Centering Error Vertical	:	0.001524 Meters

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

(V14 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)			
COY1	2547.2854	0.0060	0.8504
COD1	-1568.6208	0.0097	-0.8142
	0.2983	0.0099	-0.9366
(V15 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)			
COY1	2547.2770	0.0065	0.8404
COD1	-1568.6355	0.0092	-0.8049
	0.3121	0.0086	-0.9157
(V16 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
COY1	2604.5800	0.0133	0.9524
CAST	-3801.2848	0.0202	-0.9250
	-2346.9131	0.0184	-0.9437
(V17 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
COY1	2604.5616	0.0102	0.8826
CAST	-3801.2998	0.0140	-0.8777
	-2346.8893	0.0151	-0.9073
(V18 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
COY1	715.9736	0.0121	0.9492
CR27	1796.2033	0.0180	-0.9334
	2386.4675	0.0168	-0.9689
(V19 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)			
COY1	715.9592	0.0102	0.8935
CR27	1796.1763	0.0196	-0.8967
	2386.4945	0.0164	-0.9413
(V20 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)			
1031	2562.2871	0.0102	0.9425
SM11	-2016.5094	0.0153	-0.9188
	-466.8788	0.0140	-0.9408
(V21 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
1031	2562.2768	0.0079	0.8726
SM11	-2016.5252	0.0116	-0.8632
	-466.8624	0.0121	-0.8995
(V22 PostProcessed 04-SEP-2014 14:06:29.0 1037-001-201409.asc)			
SM10	493.8504	0.0050	0.6902
SM08	-2623.5621	0.0075	-0.7181
	-2474.8491	0.0070	-0.9094
(V23 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)			
SM10	493.8347	0.0051	0.7938
SM08	-2623.5967	0.0086	-0.7315
	-2474.8189	0.0078	-0.7422
(V24 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)			
SM10	493.8397	0.0060	0.8761
SM08	-2623.5852	0.0085	-0.8403
	-2474.8345	0.0078	-0.8801
(V25 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)			
SM10	3341.5544	0.0190	0.9476
SM09	-4140.8760	0.0454	-0.9398
	-2224.0729	0.0390	-0.9803
(V26 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)			
SM10	488.7758	0.0093	0.9400
SM11	1776.4598	0.0139	-0.9163
	2207.0288	0.0128	-0.9392
(V27 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
SM10	488.7640	0.0078	0.8854
SM11	1776.4406	0.0111	-0.8866
	2207.0449	0.0120	-0.9117

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Number of GPS Vector Observations (Meters) = 60

From To	DeltaX DeltaY DeltaZ	StdErrX StdErrY StdErrZ	CorrelXY CorrelXZ CorrelYZ
(V1 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)			
P271	-752.9454	0.0096	0.8572
COY1	-4923.8725	0.0144	-0.8403
	-5746.0067	0.0129	-0.9366
(V2 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
P271	-752.9585	0.0077	0.8068
COY1	-4923.8892	0.0119	-0.7546
	-5745.9901	0.0119	-0.9140
(V3 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)			
P271	-36.9762	0.0203	0.9595
CR27	-3127.6721	0.0414	-0.9651
	-3359.5302	0.0347	-0.9799
(V4 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
P271	-36.9872	0.0109	0.9386
CR27	-3127.6915	0.0178	-0.9311
	-3359.5126	0.0164	-0.9652
(V5 PostProcessed 03-SEP-2014 14:32:29.0 1037-001-201409.asc)			
P271	1102.4947	0.0069	0.9266
1031	945.1001	0.0101	-0.8967
	1724.5077	0.0090	-0.9279
(V6 PostProcessed 04-SEP-2014 19:09:29.0 1037-001-201409.asc)			
P271	1102.4868	0.0059	0.8670
1031	945.0878	0.0086	-0.8554
	1724.5196	0.0089	-0.8984
(V7 PostProcessed 04-SEP-2014 13:46:59.0 1037-001-201409.asc)			
P271	3176.0059	0.0050	0.6951
SM10	-2847.8650	0.0080	-0.7264
	-949.3992	0.0073	-0.9107
(V8 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)			
P271	3175.9814	0.0049	0.7317
SM10	-2847.9006	0.0080	-0.6591
	-949.3669	0.0074	-0.6651
(V9 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)			
P271	3175.9888	0.0061	0.8707
SM10	-2847.8932	0.0088	-0.8237
	-949.3755	0.0081	-0.8704
(V10 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)			
P271	3664.7827	0.0117	0.9458
SM11	-1071.4086	0.0175	-0.9222
	1257.6282	0.0161	-0.9429
(V11 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
P271	3664.7711	0.0086	0.8781
SM11	-1071.4269	0.0128	-0.8669
	1257.6467	0.0133	-0.9039
(V12 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)			
P271	-7136.3762	0.0041	0.7048
UCD1	-5464.3203	0.0058	-0.7371
	-10496.2575	0.0052	-0.8683
(V13 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)			
P271	-7136.3806	0.0040	0.6686
UCD1	-5464.3285	0.0054	-0.7259
	-10496.2503	0.0049	-0.8473

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

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(V42 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)
SM08                    -4422.8140        0.0069        0.8125
COY1                      547.5408        0.0108       -0.7640
                        -2321.7369        0.0110       -0.9201
(V43 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)
SM08                    -1875.5191        0.0061        0.8700
COD1                    -1021.0666        0.0098       -0.8321
                        -2321.4527        0.0100       -0.9349
(V44 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)
SM08                    -1875.5279        0.0068        0.8490
COD1                    -1021.0749        0.0096       -0.8110
                        -2321.4456        0.0089       -0.9174
(V45 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)
SM08                    -1818.2287        0.0137        0.9509
CAST                    -3253.7289        0.0210       -0.9212
                        -4668.6679        0.0190       -0.9414
(V46 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)
SM08                    -1818.2387        0.0106        0.8813
CAST                    -3253.7435        0.0145       -0.8756
                        -4668.6457        0.0157       -0.9062
(V47 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)
SM08                     2847.7158        0.0133        0.9484
SM09                    -1517.2889        0.0198       -0.9268
                          250.7560        0.0184       -0.9711
(V48 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)
SM08                     2847.7052        0.0056        0.6116
SM09                    -1517.3030        0.0080       -0.4736
                          250.7710        0.0095       -0.7819
(V49 PostProcessed 03-SEP-2014 17:05:29.0 1037-001-201409.asc)
S16A                     4292.9231        0.0180        0.9434
RIVE                    -5026.6381        0.0260       -0.9171
                        -2533.0286        0.0243       -0.9685
(V50 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)
S16A                     4292.9099        0.0114        0.8342
RIVE                    -5026.6715        0.0230       -0.8259
                        -2532.9959        0.0210       -0.9687
(V51 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)
S16A                    -4786.4011        0.0139        0.9489
1031                     3006.2012        0.0209       -0.9268
                           58.6424        0.0192       -0.9429
(V52 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)
S16A                    -4786.4137        0.0107        0.8819
1031                     3006.1814        0.0146       -0.8793
                           58.6612        0.0161       -0.9070
(V53 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)
S16A                      628.6664        0.0203        0.9486
SM09                    -4927.6479        0.0486       -0.9408
                        -4839.3318        0.0417       -0.9807
(V54 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)
S16A                      628.6564        0.0116        0.9211
SM09                    -4927.6607        0.0201       -0.8980
                        -4839.3232        0.0186       -0.9624
(V55 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)
S16A                    -2712.8863        0.0072        0.8236
SM10                     -786.7665        0.0125       -0.7790
                        -2615.2619        0.0129       -0.9360
```

(V28 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
SM10	-3212.9788	0.0139	0.9485
CR27	-279.8002	0.0206	-0.9317
	-2410.1374	0.0194	-0.9685
(V29 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)			
SM11	2224.1149	0.0087	0.9387
S16A	-989.6889	0.0130	-0.9162
	408.2336	0.0120	-0.9374
(V30 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)			
SM11	2224.1034	0.0072	0.8861
S16A	-989.7031	0.0102	-0.8874
	408.2518	0.0110	-0.9131
(V31 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)			
UCD1	5511.3999	0.0042	0.6963
P268	-8476.2458	0.0059	-0.7509
	-5462.4091	0.0053	-0.8662
(V32 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)			
UCD1	5511.3951	0.0040	0.6703
P268	-8476.2542	0.0056	-0.7107
	-5462.4011	0.0050	-0.8494
(V33 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)			
UCD1	6383.4259	0.0097	0.8587
COY1	540.4438	0.0145	-0.8420
	4750.2535	0.0130	-0.9373
(V34 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)			
UCD1	6383.4106	0.0078	0.8154
COY1	540.4248	0.0123	-0.7643
	4750.2699	0.0125	-0.9217
(V35 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
UCD1	8988.0084	0.0149	0.9521
CAST	-3260.8461	0.0229	-0.9223
	2403.3439	0.0208	-0.9421
(V36 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)			
UCD1	8987.9863	0.0111	0.8819
CAST	-3260.8604	0.0156	-0.8757
	2403.3619	0.0153	-0.9377
(V37 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)			
COD1	57.2949	0.0105	0.9256
CAST	-2232.6530	0.0150	-0.9247
	-2347.2158	0.0159	-0.9419
(V38 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)			
COD1	57.2859	0.0083	0.9145
CAST	-2232.6724	0.0126	-0.8701
	-2347.2029	0.0117	-0.8995
(V39 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)			
SM08	-3706.8335	0.0196	0.9591
CR27	2343.7568	0.0399	-0.9646
	64.7268	0.0334	-0.9796
(V40 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)			
SM08	-3706.8425	0.0124	0.9315
CR27	2343.7488	0.0183	-0.9157
	64.7293	0.0167	-0.9674
(V41 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)			
SM08	-4422.8070	0.0086	0.8601
COY1	547.5590	0.0128	-0.8409
	-2321.7556	0.0114	-0.9342

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjustment Statistical Summary

Iterations	=	4
Number of Stations	=	17
Number of Observations	=	213
Number of Unknowns	=	50
Number of Redundant Obs	=	163

Observation	Count	Sum Squares of StdRes	Error Factor
Coordinates	26	21.798	1.047
Angles	2	0.000	0.000
Distances	3	0.000	0.006
Zeniths	2	0.000	0.000
GPS Deltas	180	154.960	1.061
Total	213	176.758	1.041

The Chi-Square Test at 5.00% Level Passed
Lower/Upper Bounds (0.891/1.108)

(V56 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)			
S16A	-2712.8948	0.0070	0.8909
SM10	-786.7763	0.0103	-0.8603
	-2615.2551	0.0095	-0.8868
(V57 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)			
P268	3476.6114	0.0152	0.9531
CAST	5215.4185	0.0233	-0.9239
	7865.7445	0.0211	-0.9431
(V58 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)			
P268	3476.5897	0.0119	0.8956
CAST	5215.3857	0.0169	-0.8890
	7865.7733	0.0163	-0.9442
(V59 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)			
RIVE	-3664.2397	0.0159	0.9502
SM09	99.0115	0.0236	-0.9285
	-2306.3269	0.0220	-0.9724
(V60 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)			
RIVE	-3664.2659	0.0095	0.8675
SM09	98.9699	0.0164	-0.8395
	-2306.2899	0.0156	-0.9609

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Convergence Angles (DMS) and Grid Factors at Stations
(Grid Azimuth = Geodetic Azimuth - Convergence)
(Elevation Factor Includes a Geoid Height Correction at Each Station))

Station	Convergence Angle	Factors: Scale	x Elevation	= Combined
UCD1	0-09-24.66	0.99996018	1.00000000	0.99996018
P268	0-13-22.57	0.99997117	1.00000368	0.99997484
P271	0-10-47.92	0.99994232	1.00000279	0.99994511
COD1	0-12-56.60	0.99995153	1.00000384	0.99995537
COY1	0-11-38.66	0.99995154	1.00000355	0.99995508
S16A	0-13-26.84	0.99993988	1.00000348	0.99994337
SM08	0-13-24.24	0.99994765	1.00000382	0.99995147
SM10	0-12-37.39	0.99994375	1.00000335	0.99994709
15	0-12-36.97	0.99994379	1.00000313	0.99994692
16	0-12-33.82	0.99994377	1.00000326	0.99994702
EX11	0-12-34.65	0.99994377	1.00000365	0.99994743
CR27	0-11-29.95	0.99994755	1.00000343	0.99995097
1031	0-10-59.42	0.99993980	1.00000323	0.99994303
SM11	0-12-23.91	0.99994047	1.00000371	0.99994418
CAST	0-13-28.38	0.99995568	1.00000405	0.99995973
SM09	0-14-48.17	0.99994724	1.00000395	0.99995119
RIVE	0-16-10.88	0.99994362	1.00000295	0.99994657
Project Averages:	0-12-37.94	0.99994786	1.00000329	0.99995115

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted Station Information

Adjusted Coordinates (Meters)

Station	N	E	Elev	Description
UCD1	596557.2693	2021690.2957	31.2765	UCD1
P268	589626.2665	2030856.1207	7.8651	P268
P271	610010.1580	2024846.1584	12.9705	P271
COD1	602678.4883	2029808.4221	6.4637	COD1
COY1	602665.9217	2026817.0537	8.3753	COY1
S16A	612168.5942	2030932.1104	8.4498	S16A
SM08	605652.9391	2030857.7158	6.4636	SM08
SM10	608811.6582	2029048.5679	9.4302	SM10
15	608777.2764	2029032.5965	10.8179	CONTROL
16	608793.8378	2028911.8157	10.0000	CONTROL AZ MARK
EX11	608789.4494	2028943.8232	7.4716	EX11
CR27	605717.8829	2026472.2946	9.0378	
1031	612222.3164	2025280.2267	10.1305	
SM11	611637.8060	2028521.6330	7.0497	
CAST	599681.9537	2031040.2322	5.1830	
SM09	605987.7372	2034076.6317	5.6389	
RIVE	608949.2090	2037236.2768	11.9588	

Adjusted Positions and Ellipsoid Heights (Meters)

Station	Latitude	Longitude	Ellip Ht	Geoid Ht
UCD1	38-32-10.449924	121-45-04.379784	0.0144	-31.2621
P268	38-28-24.681149	121-38-47.027881	-23.4309	-31.2960
P271	38-39-26.447882	121-42-52.326075	-17.8044	-30.7749
COD1	38-35-28.114860	121-39-28.223014	-24.4590	-30.9227
COY1	38-35-28.054244	121-41-31.836450	-22.5974	-30.9728
S16A	38-40-35.753116	121-38-40.255181	-22.2021	-30.6520
SM08	38-37-04.450378	121-38-44.384113	-24.3643	-30.8279
SM10	38-38-47.114446	121-39-58.691662	-21.3277	-30.7579
15	38-38-46.001294	121-39-59.357372	-19.9412	-30.7590
16	38-38-46.552748	121-40-04.349716	-20.7598	-30.7598
EX11	38-38-46.406630	121-40-03.026719	-23.2880	-30.7596
CR27	38-37-07.071749	121-41-45.661002	-21.8468	-30.8845
1031	38-40-38.146911	121-42-34.079974	-20.5680	-30.6985
SM11	38-40-18.832764	121-40-20.061430	-23.6302	-30.6799
CAST	38-33-50.779180	121-38-37.806580	-25.8065	-30.9894
SM09	38-37-14.880094	121-36-31.260494	-25.1625	-30.8014
RIVE	38-38-50.462947	121-34-20.065279	-18.7741	-30.7330
			Average:	-30.8548

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted GPS Vector Observations (Meters)

From To	Component	Adj Value	Residual	StdErr	StdRes
(V1 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)					
P271	Delta-N	-7350.7564	0.0002	0.0037	0.1
COY1	Delta-E	1947.9035	-0.0007	0.0043	0.2
	Delta-U	-9.3378	-0.0001	0.0208	0.0
	Length	7604.4747			
(V2 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)					
P271	Delta-N	-7350.7564	0.0004	0.0040	0.1
COY1	Delta-E	1947.9035	0.0017	0.0040	0.4
	Delta-U	-9.3378	-0.0270	0.0176	1.5
	Length	7604.4747			
(V3 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)					
P271	Delta-N	-4297.5852	-0.0005	0.0052	0.1
CR27	Delta-E	1612.7244	0.0012	0.0071	0.2
	Delta-U	-5.6979	0.0092	0.0570	0.2
	Length	4590.2234			
(V4 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)					
P271	Delta-N	-4297.5852	-0.0003	0.0033	0.1
CR27	Delta-E	1612.7244	0.0004	0.0033	0.1
	Delta-U	-5.6979	-0.0192	0.0261	0.7
	Length	4590.2234			
(V5 PostProcessed 03-SEP-2014 14:32:29.0 1037-001-201409.asc)					
P271	Delta-N	2210.9071	0.0003	0.0027	0.1
1031	Delta-E	441.0401	-0.0004	0.0022	0.2
	Delta-U	-3.1631	0.0063	0.0148	0.4
	Length	2254.4703			
(V6 PostProcessed 04-SEP-2014 19:09:29.0 1037-001-201409.asc)					
P271	Delta-N	2210.9071	0.0001	0.0028	0.0
1031	Delta-E	441.0401	-0.0001	0.0025	0.1
	Delta-U	-3.1631	-0.0126	0.0131	1.0
	Length	2254.4703			
(V7 PostProcessed 04-SEP-2014 13:46:59.0 1037-001-201409.asc)					
P271	Delta-N	-1211.7696	0.0003	0.0023	0.1
SM10	Delta-E	4198.8460	0.0014	0.0033	0.4
	Delta-U	-5.0190	-0.0029	0.0112	0.3
	Length	4370.2080			
(V8 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)					
P271	Delta-N	-1211.7696	0.0021	0.0044	0.5
SM10	Delta-E	4198.8460	0.0035	0.0031	1.1
	Delta-U	-5.0190	-0.0567	0.0107	5.3*
	Length	4370.2080			
(V9 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)					
P271	Delta-N	-1211.7696	0.0024	0.0031	0.8
SM10	Delta-E	4198.8460	0.0011	0.0025	0.4
	Delta-U	-5.0190	-0.0434	0.0128	3.4*
	Length	4370.2080			
(V10 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)					
P271	Delta-N	1616.1754	0.0009	0.0042	0.2
SM11	Delta-E	3680.7745	-0.0008	0.0032	0.2
	Delta-U	-7.0918	0.0088	0.0259	0.3
	Length	4019.9719			
(V11 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)					
P271	Delta-N	1616.1754	-0.0000	0.0042	0.0
SM11	Delta-E	3680.7745	-0.0005	0.0035	0.1

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted Observations and Residuals

Adjusted Coordinate Observations (Meters)
(Stations with Partially Fixed Coordinate Components)
(Elevations Marked with (*) are Ellipsoid Heights)

Station	Component	Adj Coordinate	Residual	StdErr	StdRes
UCD1	N	596557.2693	0.0011	0.0010	1.1
	E	2021690.2957	0.0011	0.0010	1.1
	Elev	0.0144*	0.0004	0.0010	0.4
P268	N	589626.2665	0.0018	0.0010	1.8
	E	2030856.1207	-0.0008	0.0010	0.8
	Elev	-23.4309*	0.0001	0.0010	0.1
P271	N	610010.1580	-0.0008	0.0010	0.8
	E	2024846.1584	0.0006	0.0010	0.6
	Elev	-17.8044*	-0.0064	0.0020	3.2*
COD1	N	602678.4883	-0.0003	0.0010	0.3
	E	2029808.4221	-0.0003	0.0010	0.3
	Elev	-24.4590*	0.0010	0.0020	0.5
COY1	N	602665.9217	-0.0005	0.0010	0.5
	E	2026817.0537	0.0002	0.0010	0.2
	Elev	-22.5974*	0.0006	0.0020	0.3
S16A	N	612168.5942	-0.0004	0.0010	0.4
	E	2030932.1104	-0.0000	0.0010	0.0
	Elev	-22.2021*	-0.0001	0.0020	0.1
SM08	N	605652.9391	0.0003	0.0010	0.3
	E	2030857.7158	-0.0008	0.0010	0.8
	Elev	-24.3643*	0.0017	0.0020	0.8
SM10	N	608811.6582	-0.0010	0.0010	1.0
	E	2029048.5679	-0.0000	0.0010	0.0
	Elev	-21.3277*	0.0013	0.0020	0.7
15	N	608777.2764	0.0000	0.0100	0.0
	E	2029032.5965	0.0000	0.0100	0.0

Adjusted Measured Angle Observations (DMS)

From	At	To	Angle	Residual	StdErr	StdRes
16	15	EX11	0-00-01.00	0-00-00.00	4.76	0.0
16	15	SM10	107-06-31.00	0-00-00.00	12.67	0.0

Adjusted Measured Distance Observations (Meters)

From	To	Distance	Residual	StdErr	StdRes
15	16	121.9202	-0.0000	FIXED	0.0
15	EX11	89.6510	0.0000	0.0031	0.0
15	SM10	37.9206	0.0000	0.0030	0.0

Adjusted Zenith Observations (DMS)

From	To	Zenith	Residual	StdErr	StdRes
15	EX11	91-45-28.00	0-00-00.00	5.35	0.0
15	SM10	91-11-33.00	-0-00-00.00	11.89	0.0

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

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(V23 PostProcessed 03-SEP-2014 18:54:29.0 1037-001-201409.asc)
SM10               Delta-N      -3165.5026      -0.0029   0.0041   0.7
SM08               Delta-E       1797.6244      -0.0008   0.0029   0.3
                   Delta-U         -4.0774      -0.0471   0.0117   4.0*
                   Length        3640.3127
(V24 PostProcessed 03-SEP-2014 14:11:29.0 1037-001-201409.asc)
SM10               Delta-N      -3165.5026       0.0015   0.0029   0.5
SM08               Delta-E       1797.6244       0.0010   0.0025   0.4
                   Delta-U         -4.0774      -0.0277   0.0125   2.2
                   Length        3640.3127
(V25 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)
SM10               Delta-N      -2842.5232      -0.0007   0.0060   0.1
SM09               Delta-E       5017.9052       0.0008   0.0100   0.1
                   Delta-U         -6.4414      -0.0030   0.0617   0.0
                   Length        5767.0922
(V26 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)
SM10               Delta-N       2828.2165      -0.0020   0.0034   0.6
SM11               Delta-E       -516.5828       0.0005   0.0027   0.2
                   Delta-U         -2.9522       0.0126   0.0206   0.6
                   Length        2875.0087
(V27 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)
SM10               Delta-N       2828.2165      -0.0005   0.0035   0.1
SM11               Delta-E       -516.5828       0.0005   0.0031   0.2
                   Delta-U         -2.9522      -0.0150   0.0175   0.9
                   Length        2875.0087
(V28 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)
SM10               Delta-N      -3084.4557      -0.0005   0.0039   0.1
CR27               Delta-E      -2587.7428       0.0007   0.0038   0.2
                   Delta-U         -1.7913       0.0220   0.0311   0.7
                   Length        4026.1996
(V29 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)
SM11               Delta-N        522.1173       0.0010   0.0032   0.3
S16A               Delta-E       2412.5126      -0.0005   0.0025   0.2
                   Delta-U          0.9510      -0.0062   0.0192   0.3
                   Length        2468.3647
(V30 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)
SM11               Delta-N        522.1173      -0.0019   0.0032   0.6
S16A               Delta-E       2412.5126       0.0018   0.0028   0.6
                   Delta-U          0.9510      -0.0317   0.0161   2.0
                   Length        2468.3647
(V31 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)
UCD1               Delta-N      -6956.3437      -0.0027   0.0020   1.4
P268               Delta-E       9147.0438       0.0026   0.0026   1.0
                   Delta-U        -33.7999       0.0033   0.0083   0.4
                   Length       11491.7479
(V32 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)
UCD1               Delta-N      -6956.3437      -0.0029   0.0020   1.5
P268               Delta-E       9147.0438       0.0023   0.0026   0.9
                   Delta-U        -33.7999      -0.0093   0.0078   1.2
                   Length       11491.7479
(V33 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)
UCD1               Delta-N       6094.8219       0.0042   0.0037   1.2
COY1               Delta-E       5143.6920       0.0017   0.0043   0.4
                   Delta-U        -27.6034       0.0045   0.0210   0.2
                   Length        7975.2858
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                    Delta-U           -7.0918        -0.0197   0.0197    1.0
                    Length          4019.9719
(V12 PostProcessed 03-SEP-2014 23:59:44.0 1037-001-201409.asc)
P271                Delta-N       -13443.5655        -0.0024   0.0020    1.2
UCD1                Delta-E        -3198.2322        -0.0003   0.0025    0.1
                    Delta-U            2.8103        -0.0110   0.0082    1.3
                    Length         13818.7608
(V13 PostProcessed 02-SEP-2014 23:59:44.0 1037-001-201409.asc)
P271                Delta-N       -13443.5655        -0.0022   0.0019    1.2
UCD1                Delta-E        -3198.2322        -0.0009   0.0026    0.3
                    Delta-U            2.8103        -0.0228   0.0076    3.0
                    Length         13818.7608
(V14 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)
COY1                Delta-N            2.4283         0.0008   0.0028    0.3
COD1                Delta-E         2991.5273         0.0023   0.0028    0.8
                    Delta-U           -2.5622         0.0013   0.0146    0.1
                    Length          2991.5294
(V15 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)
COY1                Delta-N            2.4283         0.0006   0.0028    0.2
COD1                Delta-E         2991.5273         0.0017   0.0030    0.6
                    Delta-U           -2.5622        -0.0206   0.0136    1.5
                    Length          2991.5294
(V16 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)
COY1                Delta-N        -2998.3944        -0.0002   0.0048    0.0
CAST                Delta-E         4213.2164        -0.0018   0.0034    0.5
                    Delta-U           -5.3056         0.0121   0.0299    0.4
                    Length          5171.2271
(V17 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)
COY1                Delta-N        -2998.3944        -0.0048   0.0046    1.0
CAST                Delta-E         4213.2164         0.0059   0.0041    1.5
                    Delta-U           -5.3056        -0.0203   0.0221    0.9
                    Length          5171.2271
(V18 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)
COY1                Delta-N         3053.2549         0.0034   0.0033    1.0
CR27                Delta-E         -334.4359        -0.0003   0.0032    0.1
                    Delta-U            0.0090         0.0187   0.0271    0.7
                    Length          3071.5163
(V19 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)
COY1                Delta-N         3053.2549         0.0014   0.0042    0.3
CR27                Delta-E         -334.4359        -0.0023   0.0047    0.5
                    Delta-U            0.0090        -0.0220   0.0268    0.8
                    Length          3071.5163
(V20 PostProcessed 03-SEP-2014 15:05:29.0 1037-001-201409.asc)
1031                Delta-N         -594.9093         0.0007   0.0037    0.2
SM11                Delta-E         3239.7019         0.0000   0.0029    0.0
                    Delta-U           -3.9117         0.0013   0.0226    0.1
                    Length          3293.8732
(V21 PostProcessed 04-SEP-2014 19:25:29.0 1037-001-201409.asc)
1031                Delta-N         -594.9093        -0.0003   0.0038    0.1
SM11                Delta-E         3239.7019         0.0005   0.0033    0.2
                    Delta-U           -3.9117        -0.0237   0.0178    1.3
                    Length          3293.8732
(V22 PostProcessed 04-SEP-2014 14:06:29.0 1037-001-201409.asc)
SM10                Delta-N        -3165.5026        -0.0028   0.0022    1.3
SM08                Delta-E         1797.6244         0.0040   0.0032    1.2
                    Delta-U           -4.0774         0.0012   0.0107    0.1
                    Length          3640.3127
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(V45 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)
SM08              Delta-N        -5971.9156        0.0013   0.0051   0.3
CAST              Delta-E          159.2403       -0.0012   0.0036   0.3
                  Delta-U           -4.2478        0.0094   0.0308   0.3
                  Length          5974.0398
(V46 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)
SM08              Delta-N        -5971.9156       -0.0050   0.0048   1.0
CAST              Delta-E          159.2403       -0.0004   0.0043   0.1
                  Delta-U           -4.2478       -0.0183   0.0230   0.8
                  Length          5974.0398
(V47 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)
SM08              Delta-N          322.2540        0.0008   0.0037   0.2
SM09              Delta-E         3220.3539       -0.0001   0.0036   0.0
                  Delta-U           -1.6183        0.0299   0.0297   1.0
                  Length          3236.4378
(V48 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)
SM08              Delta-N          322.2540        0.0001   0.0049   0.0
SM09              Delta-E         3220.3539        0.0016   0.0040   0.4
                  Delta-U           -1.6183        0.0068   0.0121   0.6
                  Length          3236.4378
(V49 PostProcessed 03-SEP-2014 17:05:29.0 1037-001-201409.asc)
S16A              Delta-N        -3244.2216        0.0009   0.0051   0.2
RIVE              Delta-E         6291.8603       -0.0022   0.0051   0.4
                  Delta-U           -0.4987       -0.0019   0.0392   0.0
                  Length          7079.0169
(V50 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)
S16A              Delta-N        -3244.2216       -0.0026   0.0043   0.6
RIVE              Delta-E         6291.8603       -0.0085   0.0067   1.3
                  Delta-U           -0.4987       -0.0499   0.0322   1.6
                  Length          7079.0169
(V51 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)
S16A              Delta-N           75.8166       -0.0014   0.0049   0.3
1031              Delta-E        -5651.9516        0.0012   0.0038   0.3
                  Delta-U           -0.8673        0.0090   0.0310   0.3
                  Length          5652.4602
(V52 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)
S16A              Delta-N           75.8166       -0.0014   0.0049   0.3
1031              Delta-E        -5651.9516        0.0016   0.0043   0.4
                  Delta-U           -0.8673       -0.0211   0.0233   0.9
                  Length          5652.4602
(V53 PostProcessed 04-SEP-2014 21:01:44.0 1037-001-201409.asc)
S16A              Delta-N        -6193.4399       -0.0027   0.0064   0.4
SM09              Delta-E         3120.4721       -0.0020   0.0106   0.2
                  Delta-U           -6.7382       -0.0112   0.0660   0.2
                  Length          6935.1344
(V54 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)
S16A              Delta-N        -6193.4399        0.0006   0.0041   0.2
SM09              Delta-E         3120.4721       -0.0002   0.0041   0.0
                  Delta-U           -6.7382       -0.0291   0.0292   1.0
                  Length          6935.1344
(V55 PostProcessed 04-SEP-2014 19:21:29.0 1037-001-201409.asc)
S16A              Delta-N        -3349.7281       -0.0032   0.0038   0.8
SM10              Delta-E        -1896.7596       -0.0014   0.0038   0.4
                  Delta-U           -0.2893       -0.0020   0.0186   0.1
                  Length          3849.4643
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APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

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(V34 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)
UCD1               Delta-N         6094.8219      0.0065   0.0040    1.6
COY1               Delta-E         5143.6920      0.0047   0.0040    1.2
                   Delta-U          -27.6034     -0.0246   0.0183    1.3
                   Length          7975.2858
(V35 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)
UCD1               Delta-N         3099.1291      0.0032   0.0055    0.6
CAST               Delta-E         9358.8291     -0.0049   0.0039    1.3
                   Delta-U          -33.4332      0.0121   0.0337    0.4
                   Length          9858.6714
(V36 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)
UCD1               Delta-N         3099.1291      0.0040   0.0040    1.0
CAST               Delta-E         9358.8291      0.0063   0.0045    1.4
                   Delta-U          -33.4332     -0.0178   0.0238    0.7
                   Length          9858.6714
(V37 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)
COD1               Delta-N        -3001.2791     -0.0035   0.0039    0.9
CAST               Delta-E         1220.5684      0.0014   0.0034    0.4
                   Delta-U           -2.1722      0.0210   0.0237    0.9
                   Length          3239.9797
(V38 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)
COD1               Delta-N        -3001.2791     -0.0004   0.0040    0.1
CAST               Delta-E         1220.5684     -0.0011   0.0029    0.4
                   Delta-U           -2.1722     -0.0036   0.0185    0.2
                   Length          3239.9797
(V39 PostProcessed 03-SEP-2014 21:14:44.0 1037-001-201409.asc)
SM08               Delta-N           82.0340     -0.0054   0.0051    1.1
CR27               Delta-E        -4385.3494     -0.0023   0.0068    0.3
                   Delta-U            1.0114      0.0062   0.0549    0.1
                   Length          4386.1167
(V40 PostProcessed 04-SEP-2014 17:13:59.0 1037-001-201409.asc)
SM08               Delta-N           82.0340     -0.0001   0.0035    0.0
CR27               Delta-E        -4385.3494      0.0011   0.0038    0.3
                   Delta-U            1.0114     -0.0043   0.0272    0.2
                   Length          4386.1167
(V41 PostProcessed 04-SEP-2014 14:32:59.0 1037-001-201409.asc)
SM08               Delta-N        -2971.3896     -0.0001   0.0033    0.0
COY1               Delta-E        -4052.4597      0.0008   0.0038    0.2
                   Delta-U           -0.2129      0.0006   0.0185    0.0
                   Length          5025.0956
(V42 PostProcessed 03-SEP-2014 19:18:44.0 1037-001-201409.asc)
SM08               Delta-N        -2971.3896     -0.0027   0.0035    0.8
COY1               Delta-E        -4052.4597     -0.0028   0.0035    0.8
                   Delta-U           -0.2129     -0.0261   0.0161    1.6
                   Length          5025.0956
(V43 PostProcessed 03-SEP-2014 19:22:14.0 1037-001-201409.asc)
SM08               Delta-N        -2970.4759     -0.0011   0.0029    0.4
COD1               Delta-E        -1060.9306     -0.0016   0.0026    0.6
                   Delta-U           -0.8765     -0.0032   0.0147    0.2
                   Length          3154.2513
(V44 PostProcessed 04-SEP-2014 15:27:29.0 1037-001-201409.asc)
SM08               Delta-N        -2970.4759      0.0006   0.0029    0.2
COD1               Delta-E        -1060.9306      0.0016   0.0031    0.5
                   Delta-U           -0.8765     -0.0168   0.0142    1.2
                   Length          3154.2513
```

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Adjusted Bearings (DMS) and Horizontal Distances (Meters)

(Relative Confidence of Bearing is in Seconds)

From	To	Grid Bearing	Grid Dist Grnd Dist	95% RelConfidence Brg	Dist	PPM
15	16	N82-11-32.53W	121.9110 121.9175	137.07	0.0000	0.3822
15	EX11	N82-11-31.54W	89.6041 89.6088	137.57	0.0075	83.9499
15	SM10	N24-54-58.45E	37.9103 37.9123	133.52	0.0070	185.6037
1031	P271	S11-06-05.39W	2254.3425 2254.4686	0.29	0.0036	1.6145
1031	S16A	S89-27-19.47E	5652.1390 5652.4599	0.14	0.0034	0.6095
1031	SM11	S79-46-40.53E	3293.6860 3293.8718	0.26	0.0035	1.0720
CAST	COD1	N22-20-47.39W	3239.8419 3239.9794	0.21	0.0037	1.1303
CAST	COY1	N54-45-22.14W	5171.0059 5171.2261	0.15	0.0034	0.6576
CAST	P268	S01-02-56.12W	10057.3726 10057.7026	0.07	0.0039	0.3829
CAST	SM08	N01-45-02.98W	5973.7742 5974.0396	0.11	0.0038	0.6324
CAST	UCD1	S71-31-14.62W	9858.2435 9858.6375	0.08	0.0034	0.3470
COD1	COY1	S89-45-33.50W	2991.3948 2991.5288	0.17	0.0024	0.8089
COD1	SM08	N19-25-52.52E	3154.1044 3154.2513	0.15	0.0025	0.7853
COY1	CR27	N06-26-41.96W	3071.3720 3071.5163	0.26	0.0037	1.2135
COY1	P271	N15-01-18.95W	7604.0933 7604.4731	0.07	0.0023	0.3024
COY1	SM08	N53-31-36.20E	5024.8605 5025.0953	0.09	0.0025	0.4882
COY1	UCD1	S40-00-19.61W	7974.9157 7975.2537	0.06	0.0025	0.3151
CR27	P271	N20-44-57.42W	4589.9831 4590.2216	0.17	0.0037	0.8041
CR27	SM08	S89-09-05.64E	4385.9021 4386.1160	0.18	0.0038	0.8756
CR27	SM10	N39-47-06.34E	4025.9943 4026.1995	0.19	0.0040	0.9924
P268	UCD1	N52-54-15.12W	11491.3510 11491.7240	0.04	0.0024	0.2103
P271	SM10	S74-04-55.91E	4369.9711 4370.2066	0.10	0.0021	0.4894
P271	SM11	N66-06-51.52E	4019.7452 4019.9677	0.17	0.0030	0.7536
P271	UCD1	S13-12-07.50W	13818.0926 13818.7493	0.03	0.0021	0.1550
RIVE	S16A	N62-56-51.72W	7078.6267 7079.0161	0.20	0.0055	0.7776
RIVE	SM09	S46-51-15.57W	4330.5511	0.22	0.0067	1.5371

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(V56 PostProcessed 03-SEP-2014 15:12:29.0 1037-001-201409.asc)
S16A                Delta-N        -3349.7281       -0.0005    0.0034    0.1
SM10                Delta-E        -1896.7596        0.0007    0.0027    0.2
                    Delta-U           -0.2893       -0.0163    0.0151    1.1
                    Length          3849.4643
(V57 PostProcessed 04-SEP-2014 15:14:29.0 1037-001-201409.asc)
P268                Delta-N        10055.2196        0.0017    0.0055    0.3
CAST                Delta-E          223.2452       -0.0002    0.0039    0.1
                    Delta-U          -10.3280        0.0278    0.0343    0.8
                    Length         10057.7028
(V58 PostProcessed 03-SEP-2014 19:18:14.0 1037-001-201409.asc)
P268                Delta-N        10055.2196        0.0036    0.0041    0.9
CAST                Delta-E          223.2452        0.0011    0.0045    0.2
                    Delta-U          -10.3280       -0.0209    0.0256    0.8
                    Length         10057.7028
(V59 PostProcessed 03-SEP-2014 17:11:44.0 1037-001-201409.asc)
RIVE                Delta-N        -2946.7218       -0.0020    0.0043    0.5
SM09                Delta-E        -3173.7044       -0.0031    0.0043    0.7
                    Delta-U           -7.8596        0.0267    0.0355    0.8
                    Length          4330.7772
(V60 PostProcessed 04-SEP-2014 21:14:44.0 1037-001-201409.asc)
RIVE                Delta-N        -2946.7218       -0.0002    0.0037    0.0
SM09                Delta-E        -3173.7044       -0.0026    0.0043    0.6
                    Delta-U           -7.8596       -0.0348    0.0239    1.5
                    Length          4330.7772
```

APPENDIX D – STAR*NET NETWORK ADJUSTMENT REPORT

Error Propagation

Station Coordinate Standard Deviations (Meters)

Station	N	E	Elev
UCD1	0.000718	0.000771	0.000968
P268	0.000829	0.000867	0.000984
P271	0.000703	0.000721	0.001779
COD1	0.000809	0.000802	0.001914
COY1	0.000749	0.000756	0.001882
S16A	0.000850	0.000821	0.001937
SM08	0.000731	0.000728	0.001844
SM10	0.000728	0.000716	0.001808
15	0.004991	0.009154	0.002838
16	0.036994	0.004977	0.000000
EX11	0.028416	0.006769	0.003668
CR27	0.001499	0.001520	0.011151
1031	0.001556	0.001354	0.007579
SM11	0.001393	0.001203	0.007017
CAST	0.001463	0.001255	0.007831
SM09	0.001940	0.001902	0.009146
RIVE	0.002461	0.002671	0.015661

Station Coordinate Error Ellipses (Meters)
Confidence Region = 95%

Station	Semi-Major Axis	Semi-Minor Axis	Azimuth of Major Axis	Elev
UCD1	0.001891	0.001754	79-43	0.001898
P268	0.002122	0.002027	84-26	0.001929
P271	0.001770	0.001715	70-44	0.003487
COD1	0.002030	0.001912	40-17	0.003751
COY1	0.001913	0.001770	48-24	0.003688
S16A	0.002085	0.002005	13-58	0.003797
SM08	0.001832	0.001737	42-42	0.003614
SM10	0.001786	0.001747	20-55	0.003544
15	0.024477	0.007223	114-55	0.005562
16	0.091157	0.006216	173-23	0.000000
EX11	0.070845	0.009660	168-56	0.007190
CR27	0.003825	0.003559	50-39	0.021856
1031	0.003809	0.003313	179-32	0.014854
SM11	0.003412	0.002942	174-53	0.013754
CAST	0.003581	0.003072	1-43	0.015349
SM09	0.005241	0.004095	42-39	0.017925
RIVE	0.007201	0.005213	52-34	0.030694

			4330.7724			
S16A	SM09	S26-57-53.25E	6934.7680	0.15	0.0042	0.6104
			6935.1338			
S16A	SM10	S29-17-46.82W	3849.2533	0.13	0.0025	0.6465
			3849.4642			
S16A	SM11	S77-34-53.86W	2468.2255	0.29	0.0030	1.2100
			2468.3643			
SM08	SM09	N84-03-43.34E	3236.2802	0.30	0.0047	1.4669
			3236.4377			
SM08	SM10	N29-48-06.51W	3640.1268	0.13	0.0022	0.5970
			3640.3114			
SM09	SM10	N60-40-48.16W	5766.7977	0.19	0.0043	0.7476
			5767.0909			
SM10	SM11	N10-33-41.47W	2874.8515	0.21	0.0035	1.2037
			2875.0078			

The OPUS Projects adjustment produced a SEUW of 0.500, which is in the middle of the acceptable range. The OPUS Projects adjustment report is attached as Appendix B.

Following the OPUS Projects adjustment, GPS data taken at 14 stations (including the CORS P268, P271 and UCD1) was processed in Trimble Business Center (TBC) v2.81 using precise orbits and NGS absolute antenna models. This was done primarily to produce vector data for use in a combined GPS-terrestrial adjustment using Star*Net v6.0. However, a minimally-constrained adjustment of the GPS data was performed in TBC to ensure data quality. This adjustment produced a SEUW of 1.96, indicating that the accuracy of the data is somewhat lower than predicted by the baseline processor. However, the Trimble baseline processor is known to be optimistic, and this value is acceptable for the project. (Note that the acceptable SEUW range for OPUS Projects is based on a different set of parameters and is not directly comparable to the SEUW value produced by TBC.) The minimally-constrained adjustment report is attached as Appendix C.

The adjusted positions from the OPUS Projects adjustment for the 8 stations closest to the project area were used as constraints in the Star*Net adjustment, using the standard errors for these station positions (latitude, longitude and ellipsoid height) as reported by OPUS Projects. This adjustment incorporated both GPS and terrestrial measurements, and produced a SEUW of 1.041 after scaling the GPS vector standard errors by the SEUW of the TBC adjustment (1.96).

A high-resolution hybrid geoid model (GEOID12A) produced by NGS was applied during the adjustment to produce NAVD88 orthometric heights (elevations).

The final positions from the Star*Net adjustment are shown in the tables below. Values are shown in geographic format with ellipsoid height in meters (Table C), California Coordinate System of 1983 (CCS83) meters (Table D) and CCS83 feet (Table E). The complete Star*Net adjustment report is attached as Appendix D. Note that there is no Table A or Table B so that table designations remain consistent between this report and the June report, and that Tables C, D and E do not include positions for LNC2, P267, PLSB and SACR, as these were not used in the Star*Net adjustment.

Relative Error Ellipses (Meters)
Confidence Region = 95%

Stations From	To	Semi-Major Axis	Semi-Minor Axis	Azimuth of Major Axis	Vertical
15	16	0.081014	0.000047	7-48	0.005562
15	EX11	0.059760	0.007522	7-48	0.004557
15	SM10	0.024540	0.007036	114-55	0.004286
1031	P271	0.003658	0.003127	0-02	0.014715
1031	S16A	0.003973	0.003444	178-55	0.015068
1031	SM11	0.004163	0.003494	177-12	0.017284
CAST	COD1	0.003747	0.003223	2-13	0.015519
CAST	COY1	0.003764	0.003266	4-48	0.015591
CAST	P268	0.003852	0.003465	5-07	0.015433
CAST	SM08	0.003782	0.003276	3-48	0.015594
CAST	UCD1	0.003752	0.003350	5-44	0.015425
COD1	COY1	0.002545	0.002289	44-36	0.005147
COD1	SM08	0.002507	0.002280	41-18	0.005105
COY1	CR27	0.003926	0.003630	49-13	0.021921
COY1	P271	0.002457	0.002277	54-32	0.005017
COY1	SM08	0.002456	0.002228	46-59	0.005082
COY1	UCD1	0.002539	0.002325	60-40	0.004127
CR27	P271	0.003911	0.003669	52-06	0.021986
CR27	SM08	0.003958	0.003652	51-55	0.021996
CR27	SM10	0.004001	0.003713	47-39	0.022040
P268	UCD1	0.002540	0.002258	84-57	0.002665
P271	SM10	0.002185	0.002136	27-50	0.004761
P271	SM11	0.003456	0.002970	175-52	0.013864
P271	UCD1	0.002349	0.002109	81-59	0.003876
RIVE	S16A	0.007083	0.005049	53-13	0.030667
RIVE	SM09	0.006669	0.004690	51-44	0.029732
S16A	SM09	0.005229	0.004095	43-45	0.018131
S16A	SM10	0.002499	0.002356	13-38	0.005093
S16A	SM11	0.003473	0.002978	174-49	0.013871
SM08	SM09	0.005252	0.004060	41-40	0.017762
SM08	SM10	0.002247	0.002160	37-10	0.004856
SM09	SM10	0.005356	0.004249	42-15	0.018191
SM10	SM11	0.003465	0.002977	175-32	0.013910

LA15

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Prepared at the Request of Counsel

TECHNICAL MEMORANDUM

TO: John Herrick, South Delta Water Agency
Dante Nomellini, Central Delta Water Agency

DATE: December 1, 2014

FROM: Jack Dahl, EIT
Nathan Jacobsen, PE
John Lambie, PE, PG, CEG

PROJ. NO. 0611-001-01

SUBJECT:___Review and Comments to Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/EIR) - Public Draft

Executive Summary of Comments

The analysis in the EIS/EIR of Groundwater Substitution Measures considered within Alternatives 2 and 3 for Long-Term Water Transfers does not properly account the water available. The analysis of the Groundwater Substitution Measures in the EIS/EIR: 1

- improperly quantifies the groundwater depletions that would result from groundwater extraction;
- fails to properly account for the timing and quantity of groundwater flow that would have accreted to the rivers as baseflow absent the groundwater extraction;
- fails to accurately quantify the effects of exfiltration from the river to groundwater; and
- as a result significant quantities of water are being double counted as between available surface water and extracted groundwater.

The proposed mitigation measures are inadequate to offset the impacts, in some cases this is due to the inaccurate accounting of water and in other cases it is because the proposed mitigation is too ill-defined to provide substantive protection against impacts.

Groundwater Resources

The SACFEM 2013 groundwater model utilized for analysis in the EIS/EIR for Groundwater Substitution Measures does not properly account the losses of water in the rivers. This is true due to a number of deficiencies in the model's simulation code, MicroFEM and the SACFEM2013 model's construction. 2

- SACFEM2013 uses a river stage that does not vary over each time step which in effect makes the river an infinite source of water for each time step.

- SACFEM2013 does not accurately account the losses of water in the rivers because it does not contain a mathematical algorithm for accounting the flow or quantity of water in the rivers. 3
- SACFEM2013 does not accurately account the water because it treats flow between the river and aquifer as fully-saturated flow even when the model conditions recognize that hydraulically they are detached. 4
- SACFEM2013 has been configured such that extraction from Groundwater Substitution Measures are hydraulically isolated from the river (for example a vertical anisotropy of 500:1 in hydraulic conductivity at the wells in the model substantially isolates them from the rivers) 5
- SACFEM2013 does not represent accurately the depletions to groundwater that must be refilled by natural recharge or other sources due to its handling the rivers as infinite sources during each model time interval 6

SACFEM2013 is not well calibrated to actual conditions of groundwater elevation near rivers and streams. Due to its lack of calibration to actual groundwater elevation conditions, the predictive outcomes are not reliable as a basis for assessing the locations of impact and the degree of impact to Water Supply, Groundwater Resources, Water Quality, and Terrestrial Resource considerations. 7

Neither the quantity of water nor the timing of its removal from surface water is calculated correctly in SACFEM2013 due to the structural deficiencies identified in our review. One of the essential needs in an EIS/EIR on Groundwater Substitution Measures is accurate estimating of the timing of impacts to the flowing rivers and streams; SACFEM2013 does not provide accurate monthly estimates of when peak streamflow depletions will occur if Groundwater Substitution Measures are imposed in large part because of the hydraulic isolation of the pumping from the rivers configured into the model. 8

The magnitude of groundwater depletion is underestimated in SACFEM2013 due to its use of infinite river sources. 9

The Proposed Mitigation GW-1 for aquifer desaturation resulting from Groundwater Substitution Measures, GW-1, will not adequately mitigate the impacts to groundwater users in the Seller's Area. This is due in part to the improper accounting of the exchange of surface water and groundwater in SACFEM2013 which attributes too much of the groundwater elevation variability to seasonal recharge and discharge and does not attribute enough of the variability to long term desaturation. However, the Proposed Mitigation, GW-1, will not adequately mitigate for changes in groundwater storage due to the mitigation measure's reliance upon local groundwater-subbasin management-objectives; those objectives are insufficiently quantified and thereby cannot enable timely mitigation of project impacts from Groundwater Substitution Measures. 10

The mitigation proposed for decreases in groundwater saturation of the uppermost aquifer, GW-1, are inadequately considered. SACFEM2013 does not correctly calculate the drawdown of the unsaturated aquifer and its corresponding increase in the weight of the overburden on under consolidated lithologic layers. This will result in greater impacts from Groundwater Substitution Measures than are recognized in the EIS/EIR due to inelastic subsidence and the resulting permanent loss of aquifer storage in the Seller's Area. The proposed mitigation, GW-1, will only recognize or acknowledge inelastic subsidence 11 due to Groundwater Substitution Measures after it has occurred; thus it cannot restore or offset the permanent impact of subsidence. 11

Water Supply

The "post-processing tool" referred to under evaluations of Water Supply for Water Operations Assessment does not properly account for water as it uses SACFEM2013, CalSim II, and a spreadsheet model called the Transfer Operations Model (TOM). The potential impacts to Water Supply from Groundwater Substitution Measures do not properly account the water the sources available and depleted in the Water Operations Assessment. 12

The CalSim II model utilized for analysis in the EIS/EIR does not properly account the losses of water in the rivers nor the quantities of accretionary flow of groundwater to rivers within the area modeled. Calsim II provides limited useful information to assess potential surface water impacts as the model contains unfounded assumptions, errors, and outdated simulation codes. The very poor precision of the surface water delivery model (CalSim II) used for the baseline assessment on quantities of water moving in and around the CVP and SWP leads to problems in accounting for water losses due to existing groundwater extraction and proposed groundwater extraction as Groundwater Substitution Measures. 13

TOM is utilized in the EIS/EIR to assess Impacts to Water Supply from Groundwater Substitution Measures does not and by virtue of its underpinnings of SACFEM2013 and CalSim II cannot properly account the losses of water in the rivers induced by Groundwater Substitution Measures. TOM simulates water made available under each transfer mechanism, subject to various constraints. TOM uses an assumed priority for transfer mechanisms used to make water available under Project alternatives in the following order: 14

- Groundwater substitution – for alternatives that include this mechanism
- Reservoir release
- Conserved water
- Crop idling – for alternatives that include this mechanism

Priorities for transfer mechanisms are necessary to develop groundwater pumping inputs to SACFEM2013 and simulate all transfers in TOM. Thus TOM appears to bookkeep errors in available water derived in SACFEM2013 and CalSim II. It takes input from SACFEM2013 and CalSim II to bookkeep their inaccurate information but provides no feedback to those models 15

The methodology by which Groundwater Substitution Measures for Long-Term Water Transfers are being considered and analyzed within the EIS/EIR, improperly accounts quantities of water and as a result significant quantities of water are being double counted as between available surface water and extracted groundwater. 16

Due to the improper accounting of water in Water Supply, the proposed mitigation, WS-1, is inadequate to mitigate the impacts to water availability and water flows into and through the Delta during three important periods of time: (1) the period of Groundwater Substitution pumping, April thru September; (2) the Water Transfers window, July thru September; and, (3) the period following the Water Transfers window, October to April. 17

Due to the lack of a specific formulation for the proposed Water Supply mitigation, WS-1, it is unpredictable how the mitigation will be applied. The EIS/EIR references Draft documents on Technical Information for Preparing Water Transfer Proposals (October 2013).[1] Those documents identify the need for estimating the effects of transfer operations on streamflow and describe the use of a streamflow depletion factor; however they provide no basis for Project Agency approval nor for transfer proponents to submit site-specific technical analysis supporting a streamflow depletion factor. That document which is completely relied upon in establishing proposed mitigation, WS-1, states that:

> *"Project Agencies are developing tools to more accurately evaluate the impacts of groundwater substitution transfers on streamflow. These tools may be implemented in the near future and may include a site-specific analysis that could be applied to each transfer proposal."*[2]

This future action provides no established or predictable basis for the mitigation of streamflow depletions due to Groundwater Substitution Measures. Due to the improper accounting of water in both the groundwater and surface water supply models utilized for Water Supply analysis, reliance upon these models or the analysis in this EIS/EIR by the Project Agencies would result in inappropriate estimation of the streamflow depletion factors (SDF) utilized. Examples of appropriate methodologies for quantifying SDF for Water Supply are provided in Appendices A and B. They result in short-term SDF ranging from 8% to 22% of the Groundwater Substitution Measures after the onset of pumping proposed in the EIS/EIR and long-term cumulative SDF ranging from 34% to 108.5% of annual pumping based on evaluation of the 6-year drought from 1987 to 1992. 18

The mitigation proposed for loss of Water Supply, WS-1, due to Groundwater Substitution transfers is insufficient. It does not adequately account for the impact from the resulting reductions of water available in the rivers and groundwater due to the improper accounting of water in the EIS/EIR analyses. As detailed in our analysis the mitigation measure proposed has no basis in fact, and if it did the project proponents would find that mitigation of the impacts from Groundwater Substitution Measures are not likely to meet the Project Purpose and Need and the Project Objectives.

Water Quality

Groundwater Substitution Measures for Long-Term Water Transfers effects on Delta outflows and water quality are not properly considered in the EIR/EIS. The EIS/EIR rates the effects on Delta outflows and the impact to Delta Water Quality as Less Than Significant based on improper accounting of water. The effects and impacts are likely to be Significant and thus will require mitigation.

Reservoir Releases for meeting regulatory requirements and or deliveries to Project Contractors may be diminished by streamflow depletions from current and proposed pumping conditions in areas where groundwater saturation falls below the adjoining river stage. These depletions of water available for transfer via Reservoir Releases are not quantified in the EIS/EIR. The effect of these baseline conditions impacts the availability of water to be transferred down the Sacramento River and through the 19

[1] Department of Water Resources and Bureau of Reclamation, 2013. DRAFT Technical Information for Preparing Water Transfer Proposals – Information to Parties Interested in Making Water Available for Water Transfers in 2014, October.

[2] Ibid, at p. 33.

Sacramento San-Joaquin River Delta to the CVP and SWP pumping stations that pump water south via 19
their respective aqueducts, the Delta-Mendota Canal, and the California Aqueduct.

Terrestrial Resources

Terrestrial Resource impacts are not properly accounted in the EIS/EIR due in part to the imprecision and inability of the models to assess dehydration of the soils and groundwater aquifer adjoining both small streams and large rivers.

The Proposed Mitigation, GW-1, for potential impacts to Terrestrial Resources is insufficient to mitigate 20
the impacts since it too is not sufficiently quantified in the EIS/EIR nor in the Groundwater Management Plans (GWMPs) referenced. Existing GWMPs do not contain quantified year on year metrics for subbasin depletion and refill. These GWMPs do not identify acceptable ranges of groundwater elevations for short-term or long-term groundwater that will to sustain primary functions like support for natural riparian communities upon which several endangered species rely.

Summary of Impact Statements Addressed from the Review Performed of the EIS/EIR Analyses

The fundamental concept of water accounting errors in the models and conceptualizations applied to six specific evaluations made in the EIS/EIR are addressed herein under four topic headings Groundwater Resources, Water Supply, Water Quality and Terrestrial Resources.

Potential Impact Statements from Table ES-4	**Related Alternative(s)**	**Significance to CEQA**	**Proposed Mitigation**	**Significance After Mitigation Pursuant to CEQA**
Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS
Groundwater substitution transfers could cause subsidence in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS
Groundwater substitution transfers could decrease flows in surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP reservoirs.	2, 3	S	WS-1: Streamflow Depletion Factor	LTS

Potential Impact Statements from Table ES-4	Related Alternative(s)	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Water transfers could change Delta outflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Groundwater substitution could reduce stream flows supporting natural communities in small streams	2, 3	S	GW-1	LTS
Transfer actions could alter flows in large rivers, altering habitat availability and suitability associated with these rivers	2, 3, 4	LTS	None	LTS

EPUR
Safe Water for All

Detailed Comments to EIS/EIR Analyses

Groundwater Resources

The EIS/EIR evaluates at Section 3.3.2 on Environmental Consequences/Environmental Impacts on Groundwater Levels from the Long-Term Water Transfers lists: (1) increased groundwater pumping costs due to increased pumping depth (i.e. increased depth to water in an extraction well); (2) decreased yields from groundwater due to reduction in the saturated thickness of the aquifer; (3) lowered groundwater table elevation to a level below the vegetative root zone, which could result in environmental effects. It then sets out to evaluate Item (1) under Regional Economics and (3) under Vegetation and Wildlife. Further it states that for Environmental Consequences/Environmental Impacts on Land Subsidence that excessive groundwater extraction from confined and unconfined aquifers could lower groundwater levels and decrease pore-water pressure. It notes that compression of fine-grained deposits is largely permanent and lists various negative consequences that could result. 21

Our review finds the evaluation in the EIS/EIR of impacts to Groundwater Resources from Groundwater Substitution Measures does not properly account for water and as a result is either inaccurate or insufficient to evaluate the potential environmental impacts associated with Groundwater Substitution.

Potential Impact Statements from Table ES-4	**Related Alternative(s)**	**Significance to CEQA**	**Proposed Mitigation**	**Significance After Mitigation Pursuant to CEQA**
Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS

The two assessment methods utilized for Groundwater Resources in the EIS/EIR are a numerical groundwater model, SACFEM2013, and a qualitative assessment for groundwater conditions in the Redding Area Groundwater Basin outside of the numerical groundwater limits.

The SACFEM 2013 groundwater model does not properly account water in an integrated groundwater to surface water system. This is due in part to the shortcomings in the underlying simulation code used, 22 MicroFEM, to construct the SACFEM 2013 groundwater model.[3] The MicroFEM simulation code selected for evaluation of the significance of potential impacts to groundwater lacks some essential mathematics for evaluation of the issues presented by Groundwater Substitution Measures. MicroFEM is a simulation code only for fully saturated groundwater systems whereas to evaluate the potential impacts and

[3] The following terms, referenced herein, are typical of industry nomenclature: Algorithm - an operation or calculation (e.g., the Darcy equation); Simulation Code - a sequence of programming language commands that encapsulates one or more algorithms (e.g., California DWR's IWFM program); and, Model - an application of a simulation code to a site-specific question (e.g., in this EIS/EIR-evaluation the use of MicroFEM and its construction into the groundwater model SACFEM2013)

effects of groundwater extraction near rivers in the Sacramento River Basin it is necessary to properly formulate the discharge of water from the rivers when the river at the bottom of its streambed hydraulically detaches from the groundwater aquifer due to aquifer desaturation. While MicroFEM mathematically notes the transition from saturated to unsaturated it calculates the condition of discharge as if it is fully saturated. This is incorrect and produces substantive miscalculation of the rate and quantity of movement of surface water into groundwater and thus the magnitude of the resulting groundwater depletion.

22

As can be seen in the following illustration (Figure 1) aquifer desaturation and streamflow detachment, will influence the rate of change in groundwater elevations, groundwater flow, and groundwater interaction with surface water bodies, particularly rivers and streams. We address streamflow under Water Supply.

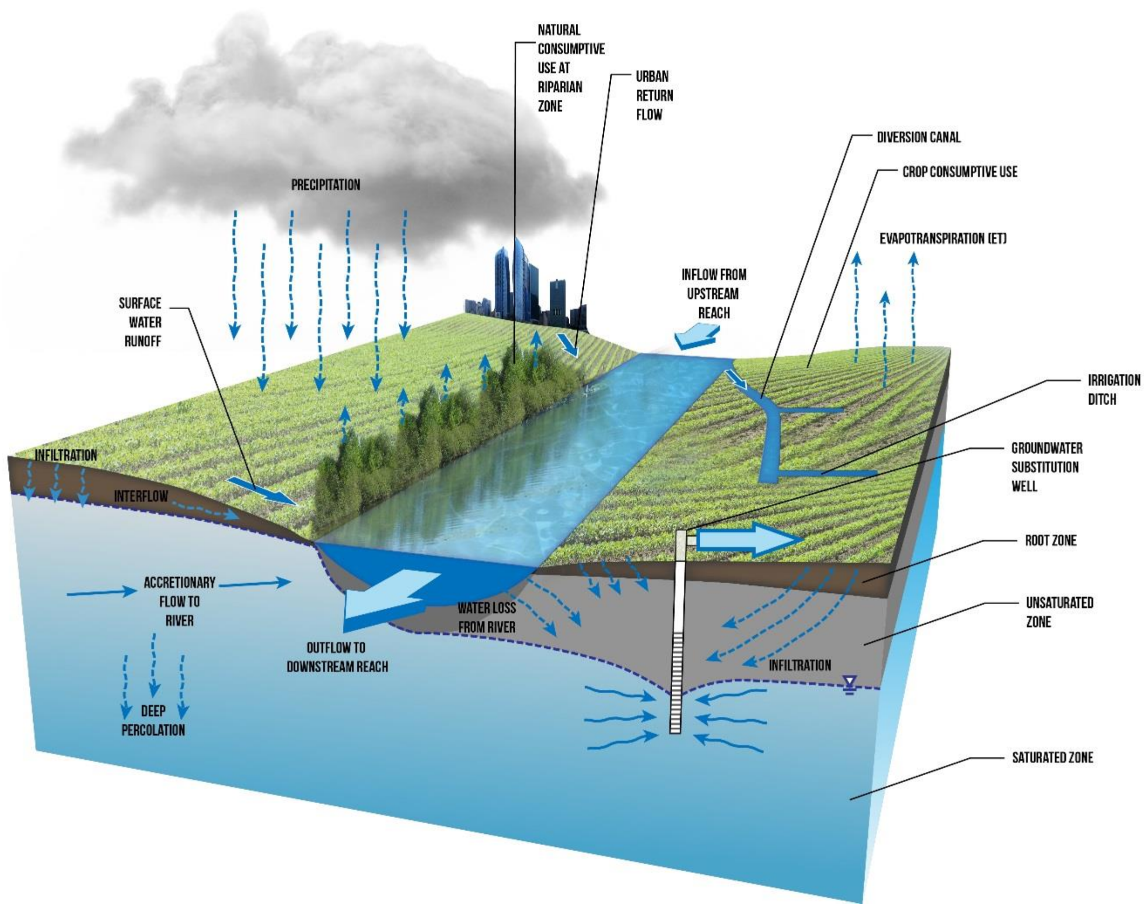

Figure 1 Groundwater Surface Water Interactions in the Hydrologic Cycle

The MicroFEM simulation code lacks the algorithm that would account the water loss from the river under unsaturated and partially saturated conditions. In order to properly account water in the groundwater system and represent the changes in the groundwater elevations as well as the streamflow depletion from the rivers and streams induced by Groundwater Substitution Measures, unsaturated or

partially saturated groundwater flow algorithms are essential components of the simulation code and/or the quantitative analysis. Since the MicroFEM simulation code does not have proper algorithms 22
to represent streamflow detachment and the resulting flux to groundwater, then as a result neither does SACFEM2013 model, the model upon which Groundwater Resource evaluations are based.

As far as potential impacts to river stage heights induced by decreases in groundwater elevations from Groundwater Substitution Measures, MicroFEM has no algorithm to calculate a change in river stage height that governs the rate of accretion or depletion to the river. Thus calculation of fluxes into and out of a river are inaccurate. They are either overestimated or underestimated based on the relative head difference between groundwater and surface water. The flow into or out of the groundwater system (called groundwater surface-water flux hereinafter) is never correct in MicroFEM due to this missing algorithm and capability in the simulation code.

For each time step the SACFEM2013 model has a user-input river stage that is invariant for the monthly time step. This results in substantive problems in properly accounting the depletion of water in the groundwater aquifer and in the groundwater surface-water flux. First with regard to accounting the depletion of groundwater SACFEM2013 does not account for the origin of surface water flowing into the groundwater domain. Surface water flowing into the groundwater domain during each monthly time- 23
step is treated as an infinite source of water; there is no formulation of river flow in the MicroFEM simulation code and hence the SACFEM2013 model has no river flow accounting to provide proper accounting of this lost surface water (That water loss accounting appears to be attempted later under the Transfer Operations Model which we address under Water Supply). A useful publication from the U.S. Geological Survey (USGS) from 1998, <u>Ground Water and Surface Water A Single Resource,</u> identifies that the hydrologic cycle demonstrates that groundwater surface-water flux behaves dynamically and that groundwater is not a source but rather the system of surface water and groundwater is a finite resource defined and governed by local and regional hydrologic and hydrogeologic conditions.[4] This dynamic interaction of groundwater surface-water fluxes within the context that it is finite in quantity and temporally controlled is not the manner in which groundwater modeling has been done for use in the EIS/EIR. Since the source of surface water in SACFEM2013 that satisfies the model estimated drawdown is mathematically infinite, an improper accounting of water available in the system occurs. This results in the double counting of available water as between available groundwater for substitution transfer and available surface water to transfer. In summary the accounting of surface water available to recharge an aquifer in SACFEM2013 is not correct due to the fundamental construct of the model.

Due to the SACFEM2013 model requirement of groundwater surface-water flux being calculated as a fully saturated flow condition, groundwater surface-water flux where the model calculated head near a river reach is below the bottom of the streambed is not properly calculated in SACFEM2013. Rates of inflow to groundwater where this occurs within the model domain for a particular model stress period are overestimated due to both the incorrect mathematical formulation as fully saturated flow and the 24
invariant stage height in that river reach for that stress period (or the following stress period if there were some model carryover of surface water depletions). Furthermore the underestimation of groundwater depletion from that same stress period is error that is carried over to the next stress

[4] Winter, T.C., J.W. Harvey, O.L. Franke, and W.M. Alley 1998. Ground Water and Surface Water A Single Resource, USGS Circular 1139, pp. 79, p. 2.

period. This cumulative error in accounting the temporal depletion of groundwater in SACFEM2013 is significant because the model then subsequently does not have correct quantification of the amount of 24
required refill water to replenish groundwater from both natural recharge and delivery and application of irrigation water. Thus there are problems in accounting water correctly in the connected groundwater and surface water system due to errors in SACFEM2013.

Unlike surface water depletions to groundwater, the accretionary flow of groundwater to the river is 25
calculated in SACFEM 2013, but the calculation is inaccurate due to the invariant stage height during each monthly time step in the model.

SACFEM2013 contains an unusual model construction feature with respect to natural or crop consumptive use and evapotranspirational loss of water. It utilizes a calculation module in MicroFEM called Drains to simulate evapotranspirational losses and groundwater discharge to land surface outside of a recognized and model surface water course. Drains were set at land surface rather than at root 26
zone depth. This is altogether an unusual construction and one that reduces the quantity of water removed by vegetation as constructed. Additional details on SACFEM2013 model review and issues noted are provided in Attachment C herein.

SACFEM2013 is not well calibrated to actual conditions of groundwater elevation near rivers and streams. There is almost no mention of model calibration in the EIS/EIR; those two words appear once at page D-13. There are a number of standard references on numerical groundwater modelling that emphasize the importance of model calibration.[5,6,7] The lack of documentation in the EIS/EIR of model calibration such as how it was conducted and what the degree of precision achieved to which outcomes, is a significant omission. Through sources cited in the EIS/EIR we were able to locate calibration information for SACFEM.[8] The peer review cited in the EIS/EIR stated: 27

> *"Review of the representative and other calibration hydrographs reveals that significant calibration issues exists in areas that rely mostly on surface water. This is mainly due to the issues of SacFEM's estimation of stream-aquifer interaction. Calibration quality improves in areas that rely mostly on groundwater."*[9]

The model documentation we reviewed demonstrated local errors in predicting groundwater elevation heads that are greater than 65 feet (see Attachment C).[10] Calibration errors of this magnitude signify that the groundwater elevations for the water table would fall below the bottom of the uppermost layer in SACFEM2013; the significance of this is that MicroFEM simulation code only calculates unconfined flow conditions in the uppermost layer of a particular model such as SACFEM2013. When actual

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[5] Reilly, T.E., and Harbaugh, A.W., 2004, Guidelines for evaluating ground-water flow models: U.S. Geological Survey Scientific Investigations Report 2004-5038, 30 p.

[6] ASTM 2001, D 5981-96 (Reapproved 2002), "Standard Guide for Calibrating a Ground-Water Flow Model Application". Published November 1996, 6 p.

[7] ASTM 1994, D 5490-93,"Standard Guide for Comparing Ground-Water Flow Model Simulations to Site-Specific Information"Published January 1994, 7 p.

[8] WRIME, 2011. Peer review of Sacramento valley Finite Element Groundwater Model (SACFEM2013), October.

[9] Ibid, p. 16.

[10] Lawson, Peter, 2009. Documentation of the SacFEM Groundwater Flow Model. CH2MHill Technical Memorandum. Prepared for Bob Niblack, California Department of Water Resources, February. This document is relied upon heavily in the peer review document cited for Section 3.3 of the EIS/EIR: WRIME,2011.

groundwater elevations fall below the bottom of Layer 1 in a number of locations, the model is miscalculating the groundwater flux. This demonstrates that the SACFEM2013 model was improperly constructed as well as poorly calibrated. Due to its lack of calibration to actual groundwater elevation conditions, the predictive outcomes are not reliable as a basis for assessing the locations of impact and 27 the degree of impact to Water Supply, Groundwater Resources, Water Quality, and Terrestrial Resource considerations. Attachment C herein highlights further critique of the SACFEM2013 based on information found in the EIS/EIR as to the model's construction and documentation that the EIS/EIR relies upon in regard to the model's construction and calibration.

Neither the quantity of water nor the timing of water's removal from surface water is calculated correctly in SACFEM2013 due to the structural deficiencies identified in our review. One of the essential needs in an EIS/EIR on Groundwater Substitution Measures is accurate estimating of the timing of impacts to the flowing rivers and streams; SACFEM2013 does not provide accurate monthly estimates of when peak streamflow depletions will occur if Groundwater Substitution Measures are imposed in large 28 part because of the hydraulic isolation of the pumping from the rivers configured into the model.

Accurately quantifying the changes in groundwater storage and groundwater elevations associated with Groundwater Substitution Measures is foundational to defining the potential impacts and their magnitude, and the metrics for the proposed mitigation measure GW-1.

Qualitative Assessments for Groundwater Resources

In section 3.3.1.3.1 Redding Area Groundwater Basin the discussion of Groundwater Production, Levels and Storage does not quantify the quantity of current groundwater pumping or the basin safe-yield without mining out groundwater in any of the six subbasins recognized in DWR Bulletin 118. There is no identification of what impacts to base flows occur from current groundwater extractions for either current Municipal & Industrial (M&I) or applied irrigation. The EIS/EIR does not quantify those groundwater levels (i.e. drawdowns) associated with existing extractions in order to establish what the acceptable groundwater levels (i.e. drawdowns) associated with Groundwater Substitution Measures in this area might be. This is foundational to establish a basis for the proposed mitigation, GW-1, to avoid impacts to existing groundwater users and to avoid impacts to the seasonal base flows in the 29 Sacramento River reaches in the Redding Area Groundwater Basin and those seasonal base flows of the 7 major tributaries to the Sacramento River within the basin. For example our review of the groundwater elevation contours on Figure 3.3-4 indicate that the Sacramento River are between 420 feet and 400 feet above Mean Sea Level between the Clear Creek join and the crossing of the I-5 freeway over the Sacramento at Anderson, CA; since the stream bottom profile of the Sacramento River is approximately 430 feet to 403 feet over this same reach the Sacramento River was losing water in this reach during the Spring of 2013. In addition our review finds that the Sacramento River streambed elevation is above the groundwater elevations of Spring 2013 depicted on Figure 3.3-4 at Colusa, California and southward to the edge of that figure; this means that the Sacramento River from Colusa, California and southward to perhaps Tyndall Landing, California is not only exfiltrating to groundwater, but it is also not gaining the accretionary flow of groundwater that historically occurred in these river reaches.

In Section 3.3.1.3.2 Sacramento Valley Groundwater Basin the discussion of Geology, Hydrogeology and 30 Hydrology notes that it was estimated by the USGS that from 1962 to 2003 that streamflow leakage

(also called direct exfiltration) amounted to 19% of total basin recharge and equated to 2,527,000 acre-feet per year (AFY) or 3,490 cubic feet per second of surface-water flow. This quantity of water does not denote the entirety of the streamflow depletion from the basin which is the: denied accretionary 30
groundwater flow to the rivers and streams within the basin. However, it is noted that this USGS estimated leakage-loss that discharges from the rivers and streams to groundwater is accounted in their CVHM model as surface water removed.[11]

The impact from surface water leakage to support the groundwater elevations reviewed in Section 3.3 is not quantified and the available response of groundwater elevations to Groundwater Substitution Measures is not quantifiable as a result. In other words if one of the principal sources to groundwater is surface water leakage and that leakage has already reached its maximum rate then the impact from further groundwater extraction must take into account that removal from storage and upgradient flow must meet the demand from Groundwater Substitution Measures.

It appears that neither quantitative nor qualitative evaluation of inflow or outflow to rivers and streams has been done in the EIS/EIR using empirical groundwater and surface water elevation data. Our 31
requests for the database of groundwater elevations used in the EIS/EIR did not yield the Spring 2013 groundwater elevation data used to generate Figure 3.3-4. Further neither the report nor the data provided to our request reveal groundwater elevation data for 2013 in the southerly portions of the Sacramento Valley beyond the extent of Figure 3.3.-4. Comparison of empirical (actual) data to mathematical representations in models is essential to assess whether the models are adequately representing the physics of the real-life system being mathematically modeled. Evaluation of empirical data such as land surface, groundwater elevations, and stream stage heights and rated flow rates, enables assessment of the direction of flux and with more sophisticated tools the probable magnitude of flux.

Proposed Mitigation for Potential Effects on Groundwater Resources

The Proposed Mitigation GW-1 for groundwater pressure decreases (a.k.a. groundwater elevations) resulting from Groundwater Substitution Measures, GW-1, will not adequately mitigate the impacts to groundwater users in the Seller's Area. Proposed Mitigation GW-1 is not quantified or quantifiable as to what groundwater pressure decreases will constitute an impact to water users in the Seller's Area.

The groundwater elevations necessary to mitigate streamflow depletions under proposed mitigation, 32
GW-1, as well as the stated impact of lowered groundwater levels for existing groundwater users must be quantifiable or else the proposed mitigation is insufficient to reduce the impacts from Groundwater Substitution Measures. For example in the Spring 2013, the Sacramento River streambed elevations are below groundwater elevations from Red Bluff, California to roughly Princeton, California (i.e. the Sacramento River is gaining flow from accretionary flows of groundwater in this lengthy reach) as depicted on Figure 3.3-4 of the EIS/EIR.

[11] Faunt, C.C., ed., 2009, Groundwater Availability of the Central Valley Aquifer, California: U.S. Geological Survey Professional Paper 1766, 225 p.

The proposed framework for GW-1 is based upon a draft application for preparing water transfer proposals for 2014 from DWR and U.S. Bureau of Reclamation and with the statement that this will be updated as appropriate.[12]

The framework provided for groundwater monitoring and the subsequent proposed mitigation in the EIS/EIR provides no substantive criteria for either monitoring or mitigation. With regard to groundwater monitoring for example at page 3.3-88 under Section 3.3.4.1.2 it states

> *"The monitoring program will incorporate a sufficient number of monitoring wells to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place."*

There is no attempt at defining the minimum number of wells, a spatial resolution laterally or vertically, nor a timeframe. The subsequent subsection on groundwater level measurement requires measurement of groundwater elevations until March of the year following the transfer; this would imply that impacts from one year's transfer are not anticipated to carry over into the following year or it implies that this is the new baseline for the subsequent year's transfer withdrawal. There is no discussion or mention of a multi-year monitoring program in the EIS/EIR with year over year metrics nor are in the draft application guidance for groundwater transfer proposals. A typical application of such a monitoring program using best available science and practice is to establish groundwater elevations in a base year and then metric changes as relative drawdown; in this manner groundwater depletion within a basin or subbasin can be assessed if it is occurring and this would encompass protections against injurious harm to Groundwater Resources if natural recharge is less than normal or slower than one seasonal cycle in providing recovery of the depletion from Groundwater Substitution Measures coupled with other groundwater uses or fluxes. With regard to proposed mitigation for example at Section 3.3.4.1.3, the EIS/EIR states: 33

"If the seller's monitoring efforts indicate that the operation of wells for groundwater substitution pumping are causing substantial adverse impacts, the seller will be responsible for mitigating any significant environmental impacts that occur."

There is no definition provided of what constitutes a substantial adverse impact. Looking back to Section 3.3.2.2 Significance Criteria one finds:

> *"A net reduction in groundwater levels that would result in adverse environmental effects or effects to non-transferring parties"*

There is no benchmark criterion for mitigation and in fact the EIS/EIR at page 3.3-90 then states:

> *"To ensure that mitigation plans will be feasible, effective, and tailored to local conditions, the plan must include the following elements:*
>
> - *A procedure for the seller to receive reports of purported environmental or effects to non-transferring parties;*
> - *A procedure for investigating any reported effect;*
> - *Development of mitigation options, in cooperation with the affected parties, for legitimate significant effects; and*

[12] Department of Water Resources and Bureau of Reclamation, 2013. DRAFT Technical Information for Preparing Water Transfer Proposals – Information to Parties Interested in Making Water Available for Water Transfers in 2014, October

- *Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs.”*

This text is extremely unclear as to: technically what is the procedure for investigation of effects; what is the meaning of “legitimate significant effects” when a multitude of overlapping influences on groundwater will occur from natural to man-made; and who would be monitoring and reporting on adverse environmental effects if not the Seller’s and if so then who would be compensating for that monitoring. Our review finds the GW-1 does not provide adequate mitigation for groundwater decreases in the Seller Service Area as it relies upon poorly defined future actions with no established, reliable, or predictable basis for the monitoring and mitigation. 33

Potential Impact Statements from Table ES-4	**Related Alternative(s)**	**Significance to CEQA**	**Proposed Mitigation**	**Significance After Mitigation Pursuant to CEQA**
Groundwater substitution transfers could cause subsidence in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS

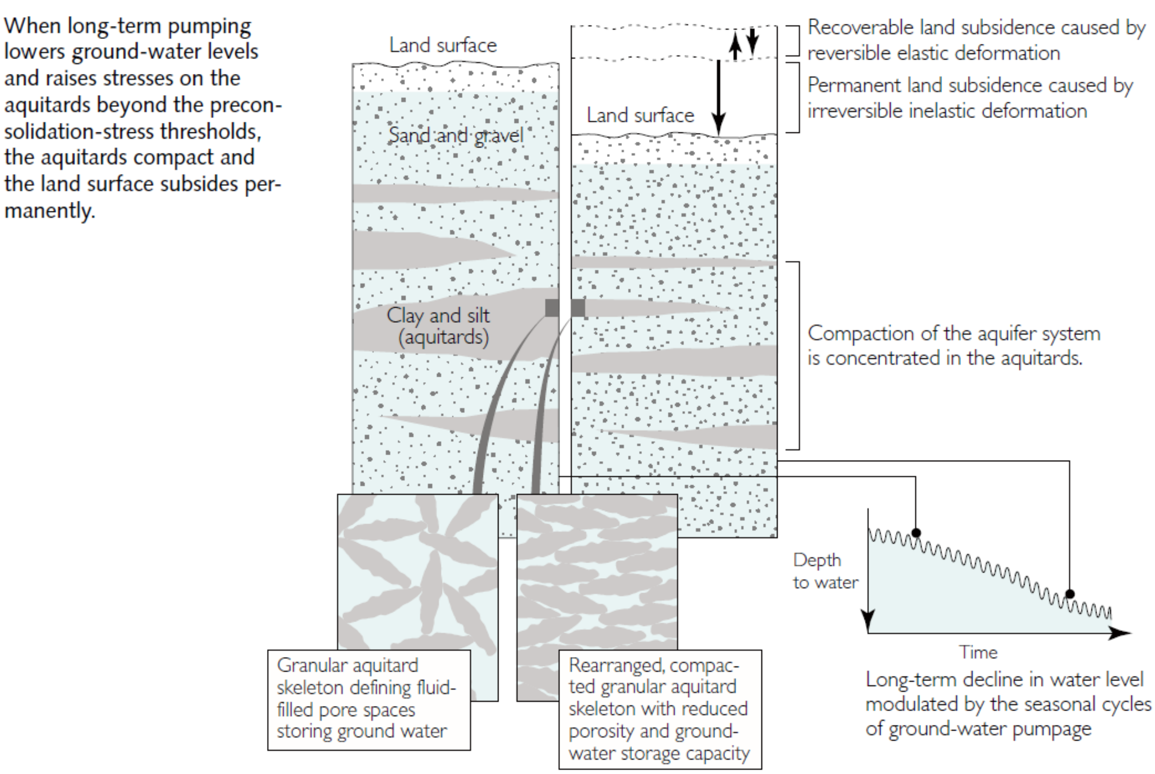

Figure 2 The mechanics of land subsidence due to changes in groundwater elevations, USGS Circular 1182

The groundwater formation in the Seller Service Area west of the Sacramento River is composed of the Tehama Formation.[13] The Tehama Formation has exhibited subsidence in Yolo County. According to the EIS/EIR similar formational and hydrogeologic characteristics exist in the Redding Area Groundwater Basin.

Groundwater elevation changes due to long term pumping can increase the effective stress on subsurface materials that are under-consolidated. This is typical of some aquitards whose skeletal materials are typically composed of fine-grained sediments and when deposited by lower-energy hydraulic processes their ionic mineral boundaries keep them under-consolidated. When the effective stress of the soil column on these aquitards is increased due to dehydration of the aquifers above them, their skeletons compact. This is known as inelastic subsidence and it causes both a permanent loss of groundwater aquifer storage capacity and a depression at the land surface (Figure 2).

The groundwater elevations depicted on Figures 3.3-8 and 3.3-9 demonstrate that groundwater 34
elevations in three of the eleven wells selected are at historic lows and under existing hydrogeologic and hydrologic conditions are on decadal declining trends. Specifically wells 11N05E32R001M, 21N03W33A004M, and 15N03W01N001M are all at historic lows at their last measurement discounting for seasonality. Each of these wells is in the western half of the Sacramento Valley Basin and thus would be expected to be overlying the Tehama Formation with its known under-consolidated units. Further groundwater extraction by Groundwater Substitution Measures will further lower groundwater elevations in both the Redding Area Groundwater Basin and the Sacramento Valley Basin. The assessment of changes in groundwater elevations reported at Table 3.3-5 is based on SACFEM2013 modeling and is incorrect due to the deficiencies and built-in errors noted for SACFEM2013 to accurately represent cumulative drawdown from Groundwater Substitution Measures. Moreover without specific well depth information and screened intervals for the handful of monitoring wells noted it is impossible in our review to assess whether they monitor the groundwater table portions of the aquifers; the unit where desaturation occurs and effective stresses that induce permanent land subsidence generally occur.

Proposed Mitigation

The mitigation proposed for the potential impacts of land subsidence due to decreases in groundwater saturation of the uppermost aquifer, GW-1, is inadequate. The monitoring measures for land subsidence in the EIS/EIR are stated at page 3.3-89 as:

> *"Subsidence monitoring will include determination of land surface elevation in strategic (determined by Reclamation) locations throughout the transfer area at the beginning and*
> *end of each transfer year. If the land surface elevation survey indicates an elevation* 35
> *decrease, then the area will require more extensive monitoring…"*

Under this monitoring program approach, permanent inelastic subsidence will have occurred prior to detection. Mitigation is offered in the form of reimbursement for infrastructure (e.g. roadway) structural damage due to permanent subsidence (albeit elastic reversible subsidence would likely also cause infrastructural damage). No mitigation is offered for the permanent loss of aquifer storage capacity.

[13] US Bureau of Reclamation, 2014. "Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report Public Draft, September, at p. 3.3-17.

Under this program of monitoring and mitigation it has to be noted at Section 3.3.5 Potentially Significant Unavoidable Impacts that this permanent impact of lost aquifer storage capacity is not mitigated by GW-1. Under Sections 3.3.6.1 and 3.3.6.2 for Cumulative Effects for Alternatives 2 and 3, respectively, which include Groundwater Substitution Measures the cumulative effects noted for land subsidence are stated as:

> *"The groundwater substitution pumping associated with the SWP transfers would occur in an area that is historically not subject to significant land subsidence. In the overall area of analysis, land subsidence is occurring in several areas, as described in Section 3.3.1.3.2."*

The statement is inaccurate. The juxtaposition of Seller locations next to historic subsidence in Yolo County makes the statement inaccurate. The EIS/EIR then goes on to say:

> *"…however, the existing subsidence along with future increases in groundwater pumping in the cumulative condition could cause potentially significant cumulative effects. The impacts of the Proposed Action would be reduced through Mitigation Measure GW-1 (Section 3.3.4.1) to less than significant. Therefore, with implementation of Mitigation Measure GW-1, the Proposed Action's incremental contribution to subsidence impacts would not be cumulatively considerable."* 35

The analysis of changes to groundwater elevations leading to this statement is inaccurate and hence the impacts anticipated are underestimated. Perhaps more to the point the Mitigation Measure, GW-1, as defined will not adequately address the impacts of groundwater drawdown on inelastic subsidence and the resulting permanent loss of aquifer storage in the Seller's Area. The proposed observation of subsidence as mitigation cannot restore or offset the impact of subsidence once it has already occurred.

It is however possible to define a monitoring and mitigation program for the risks and potential impacts of permanent Land Subsidence. Such a program of monitoring and mitigation would require evaluation of historic and current groundwater elevations in the upper groundwater aquifer units over a series of decades long cyclical hydrologic and land use conditions in each Seller Area to determine whether groundwater elevations are at historic lows. If so then mitigation for permanent land subsidence due to Groundwater Substitution Measures would require no Groundwater Substitution Measures for Long Term Water Transfers be approved until groundwater elevations increase above historic lows and within a range that accurate groundwater modeling could demonstrate would not create cumulative lowering of groundwater elevations during the period of approved water transfers.

Water Supply

At Section 3.1.2 on Environmental Consequences/Environmental Impacts on Water Supply the Assessment Methods states:

> *"Impacts to surface water supplies are analyzed by comparing the conditions in water bodies and surface supplies without implementing transfers to the expected conditions of supplies with implementation"* 36

The quantitative tool to be used in assessing impacts to supplies but not water bodies from water transfers and exports from the Delta is referred to in the EIS/EIR as a "post-processing tool." The "post-processing tool" referred to under evaluations of Water Supply for Water Operations Assessment consists of the use of the SACFEM2013 groundwater model, CalSim II, and a spreadsheet model called the Transfer Operations Model (TOM). Our review will focus on these assessment tools to evaluate potential environmental impacts and consequences from the proposed Long-Term Water Transfers Alternatives.

Section 3.1.2.2 Significance Criteria states:

> *"Impacts on surface water supplies would be considered potentially significant if the long term transfers would:*
>
> - *Result in substantial long-term adverse effects to water supply for beneficial uses"*

Putting aside the substantive issue of why short-term adverse effects to water supply for beneficial uses is not considered as a criterion, our review finds the evaluation in the EIS/EIR of impacts to Water Supply from Groundwater Substitution Measures to this criterion is either inaccurate or insufficient to evaluate the potential environmental impacts associated with Groundwater Substitution as the methods of Assessment in the EIS/EIR do not properly account water and as a result cannot be relied upon to assess potential impacts and the means of mitigation or the timing of mitigation needs. Analysis of streamflow depletions due to Groundwater Substitution Measures is not analyzed accurately in the EIS/EIR and the loss of surface water to meet Water Supply needs is not properly accounted. This inaccurate accounting results in a fraction of the groundwater extracted being double counted as available surface water for transfer. 36

No Action Alternative Evaluations in EIS/EIR

It is notable that the No Action Alternative is to look at the Environmental Consequences/Environmental Impacts in water bodies (presumably rivers and reservoirs) <u>and</u> surface supplies while the evaluation for implementing Long-Term Water Transfers is to look at surface supplies with no mention of evaluating impacts to water bodies such as rivers or reservoirs.

The quantitative tool to be used to aid in assessing impacts to surface water supplies and water bodies is CalSim II for the No Action Alternative.

CalSim II works on a monthly time-step to assess SWP and CVP operations. CalSim II generates flows as a water system operational decision support tool. CalSim II is not a hydraulic model and does not include channel characteristics such as channel roughness or cross-section geometry to simulate the water routing. As a result of CalSim II's limitations, the models inability to schedule reservoir releases on a daily basis creates water accounting inaccuracies of losses caused by routing and attenuation of upstream reservoir releases to phenomena such as streamflow depletions. Additionally, CalSim II uses simplified flow routing rules (on a monthly time-step) which result in inaccuracies associated with how the SWP and CVP operate in extreme hydrologic conditions, especially in the driest years (DWR and USBOR, 2004 & Ford et al., 2006).[14,15] 37

[14] Department of Water Resources and U.S. Bureau of Reclamation (DWR and USROR, 2004). Peer Review Response: A Report by DWR/Reclamation in Reply to the Peer Review of the CalSim-II Model Sponsored by the CALFED Science Program In December 2003, August, 2004

[15] Ford, D., Grober, L., Harmon, T., Lund, J.(Chair), McKinney, D. (Ford et al., 2006). Review Panel Report San Joaquin River Valley CalSim II Model Review. CALFED Science Program – California Water and Environment Modeling Forum. January 12, 2006.

CalSim II was developed over a decade ago to assess new storage and conveyance facilities in the CVP & SWP systems on a monthly time-step. Use of CalSim II has yielded significant scrutiny on its ability to provide relevant data to assess potential future impacts (Close, A. et al, 2003).[16] The CalSim II model presented in the EIS was used for the baseline conditions (2014 planning horizon) and was not used to assess potential changes resulting in future land use and hydrologic/metrological conditions. The baseline assessment can only assess how the Long-Term Transfer Project would impact the environment if it was in-place from 1970-2003 and therefore cannot assess potential impacts of future conditions that are different than the baseline conditions such as various climate change scenarios. 37

Alternative 2 and 3 Evaluations in EIS/EIR

The EIS/EIR reaches the following conclusion with regard to Potential Impacts to Water Supply from Groundwater Substitution Measures.

Potential Impact Statements from Table ES-4	**Related Alternative(s)**	**Significance to CEQA**	**Proposed Mitigation**	**Significance After Mitigation Pursuant to CEQA**
Groundwater substitution transfers could decrease flows in surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP reservoirs.	2, 3	S	WS-1: Streamflow Depletion Factor	LTS

The analysis of Environmental Consequences/Environmental Impacts is not done accurately nor with a complete conceptual model of the interactive groundwater and surface water system that constitute the Water Supply. At page 3.1.5 in Section 3.1.2.4.1 the analysis states that groundwater basins are naturally recharged after drawdown by rainfall and surface water to groundwater flux, thereby depleting available in stream flow. It goes on to state that the accretionary flow of groundwater to surface water can be intercepted by groundwater extraction; however, it fails to note that this is a depletion of available surface water and water for other beneficial uses such as the health of the riparian and hyporheic zones. As detailed further in our review that follows a proper conceptual model of the hydrologic system for Water Supply demonstrates that the water deprived for the natural consumptive use, evapotranspiration and potentially evaporation via Groundwater Substitution Measures is the likely conserved-water available. The analysis of Water Supply is improperly conceptualized. 38

Additionally at page 3.1.6 in Section 3.1.2.4.1 the EIS/EIR states:

> *"Transfers would not affect whether the water flow and quality standards are met… but only Reclamation and DWR water supplies"*

[16] Close, A., Haneman, W.M., Labadie, J.W., Loucks D.P. (Chair), Lund, J.R., McKinney, D.C., and Stedinger, J.R. (Close, A. et al.). Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California. Submitted to the California Bay Delta Authority Science Program Association of Bay Governments. Oakland, California. December 4, 2003.

The EIS/EIR notes that it is the State and Federal projects responsibility to maintain water quality standards in the Sacramento River, its tributaries, and the Delta. It then anticipates hypothetically that if the streamflow depletion resulting from Groundwater Substitution Measures results in decreased river flows then USBOR and DWR would modify operations by decreasing Delta exports or release of additional water from reservoirs to meet Delta outflow and/or water quality standards; however as documented in Attachment D herein the Federal and State projects were unable to maintain these standards in 2013 due to dry year conditions and a lack of available in-stream flow and releases of water. 38

The quantitative tool used in assessing impacts to supplies but not water bodies from water transfers and exports from the Delta is referred to in the EIS/EIR as a post-processing tool. From Appendix B,

> *"The post-processing tool also includes changes in flows in waterways caused by streamflow depletion from groundwater substitution. Data for the post-processing tool was provided by the SACFEM2013 model, which includes highly variable hydrology (from very wet periods to very dry periods) was used as a basis for simulating groundwater substitution pumping."*

39

The EIS/EIR used two other models, CalSim II and a spreadsheet accounting model referred to as TOM, to attempt to properly account streamflow depletions. A general technical reference from the U.S. Geological Survey (USGS) published in 1998 entitled <u>Ground Water and Surface Water - A Single Resource</u> identifies that the hydrologic cycle demonstrates that groundwater is not a source of water but rather behaves as a reservoir, receiving and releasing water as governed by local and regional hydrologic and hydrogeologic conditions.[17] The use of the combination of three models does not properly account for water and thus the evaluation of *"how long-term transfers could benefit or adversely affect water supplies"* does not accurately identify potential impacts to available-water for Water Supply.

[17] Winter, T.C., J.W. Harvey, O.L. Franke, and W.M. Alley 1998. Ground Water and Surface Water A Single Resource, USGS Circular 1139, pp. 79, p. 2.

Figure 3 depicts the overall hydrologic cycle in Water Supply. The only source of true supply is precipitation in the form of rain, snow, or dew. Groundwater is not a source but an interactive reservoir.

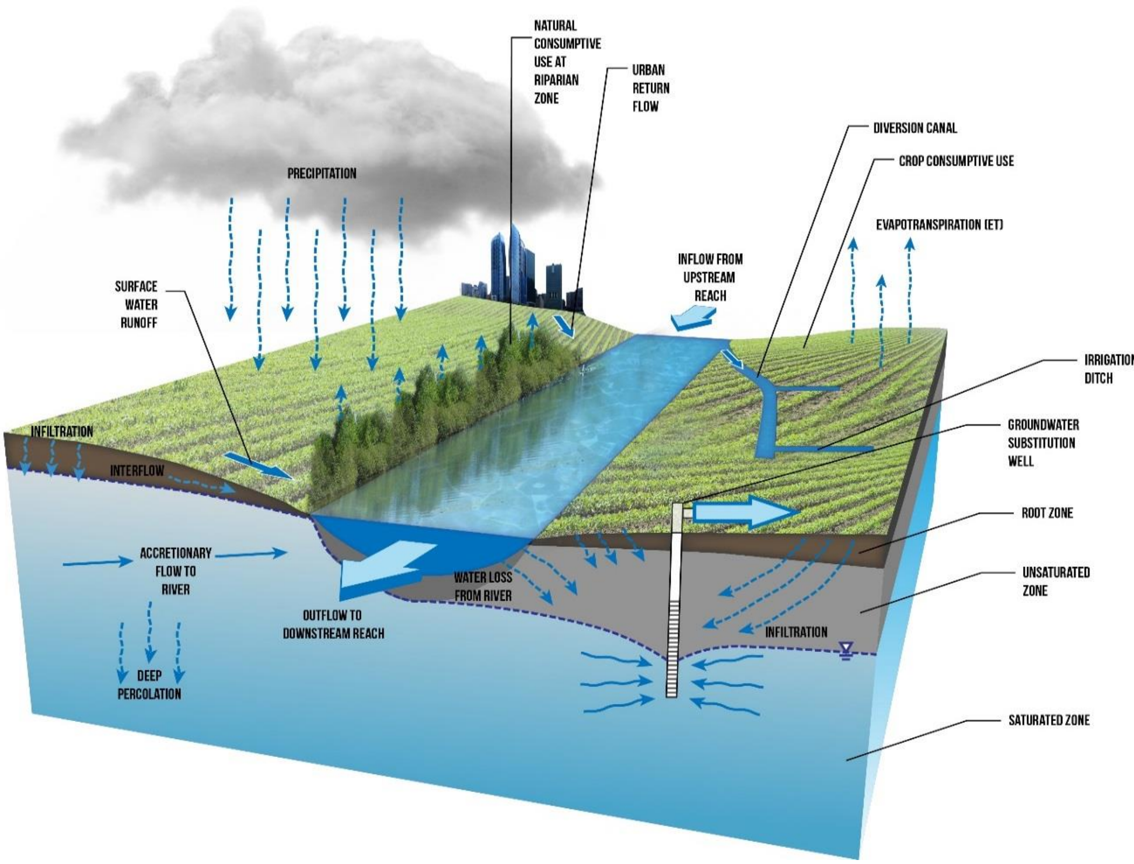

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Figure 3 Hydrologic Cycle Overview with regard to Water Supply Evaluation

For groundwater in the wells near enough to a river to have the cone of depression reach the river within the hydraulic capture zone of the well the following statement applies:

> *"When pumping of a well near a river begins, water is drawn, at first, from the water table in the immediate neighborhood of the well. As the zone of influence widens, however, it begins to draw a part of its flow from the river and, ultimately, the river supplies the entire flow"*
>
> - Robert Glover and Glenn Balmer[18]

This clear statement on the depletion of a river flow by the same rate as that withdrawn from the well is the opening of Glover and Balmer's 1954 paper on their mathematical analysis of river depletion by extraction from a nearby well. Glover and Balmer's work followed upon the first analysis of the

[18] Glover, R.E. and G.G Balmer. (1954). River depletion resulting from pumping a well near a river. *Transactions, American Geophysical Union,* v. 35

depletion of streamflow induced by an extraction well and its zone of capture done by C.V. Theis of the USGS in 1941.**[19]**

Dr. Theis commented in his 1941 paper on one aspect of the analysis of the overall effects of extraction in an alluvial river valley on the flow into and from a river:

> *"…the flux 'from the river' will be spoken of in the following treatment, the flux may be either an actual movement of water from the river or a decrease of the customary movement of water to the river"*
>
> - C.V. Theis

This customary movement of water is also commonly known as the accretionary flow of groundwater to the river; it is accretionary flow of groundwater to a river that provides the observable and measurable flow of water in a free-flowing stream during lengthy dry periods when no rain or snowmelt provides the baseflow in a river or stream (i.e. not an ephemeral stream or arroyo). In the illustration below (Figure 4) it can be seen that consistent with Dr. Theis observation on the flux "from the river" the impact to the river is due to loss of accretionary flow to the river and not as a result of direct streamflow 39

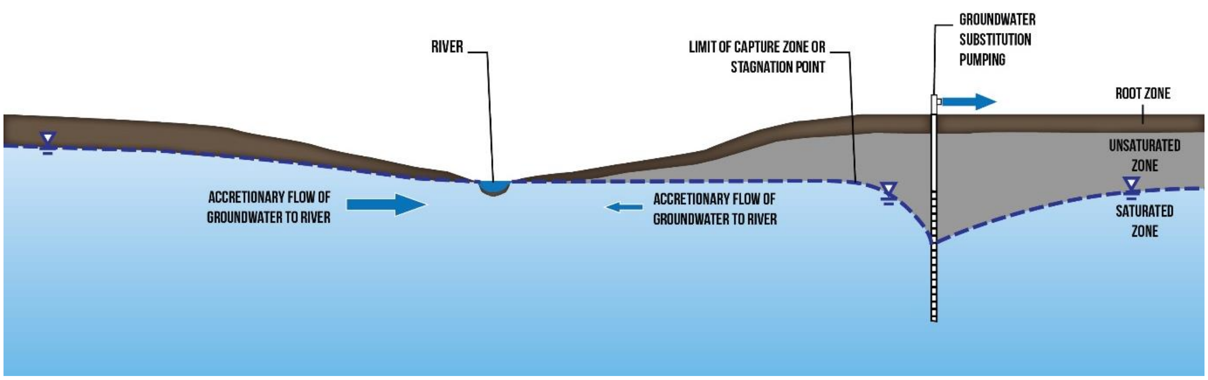

Figure 4 Cross-Sectional View of Extraction Well Depleting the Accretion of Flow to a River

depletion by way of river exfiltration. This phenomena from a well located some distance from the river results in streamflow depletion; the principal difference between this case and the one where the zone of capture to the well reaches the streambed of the river is the timing of the streamflow depletion.

L.K. Wenzel of the USGS in the peer-reviewed Discussion of this seminal paper by Dr. Theis from 1941 offered this observation:

> *"It is possible that in some localities all or a part of the water removed from the well may be obtained indirectly by reducing the amount of water that is transpired by plants from the zone of saturation. This is accomplished, of course, through the lowering of the water-table and capillary fringe to some depth below the roots of the plants."*
>
> - L.K. Wenzel[20]

[19] Theis, C.V., 1941, The effect of a well on the flow of a nearby stream: *Transactions, American Geophysical Union*, v. 22, part 3, p. 734-737.

[20] Wenzel, L.K., 1941, Discussion re: The effect of a well on the flow of a nearby stream: *Transactions, American Geophysical Union*, v. 22, part 3, p. 737-738.

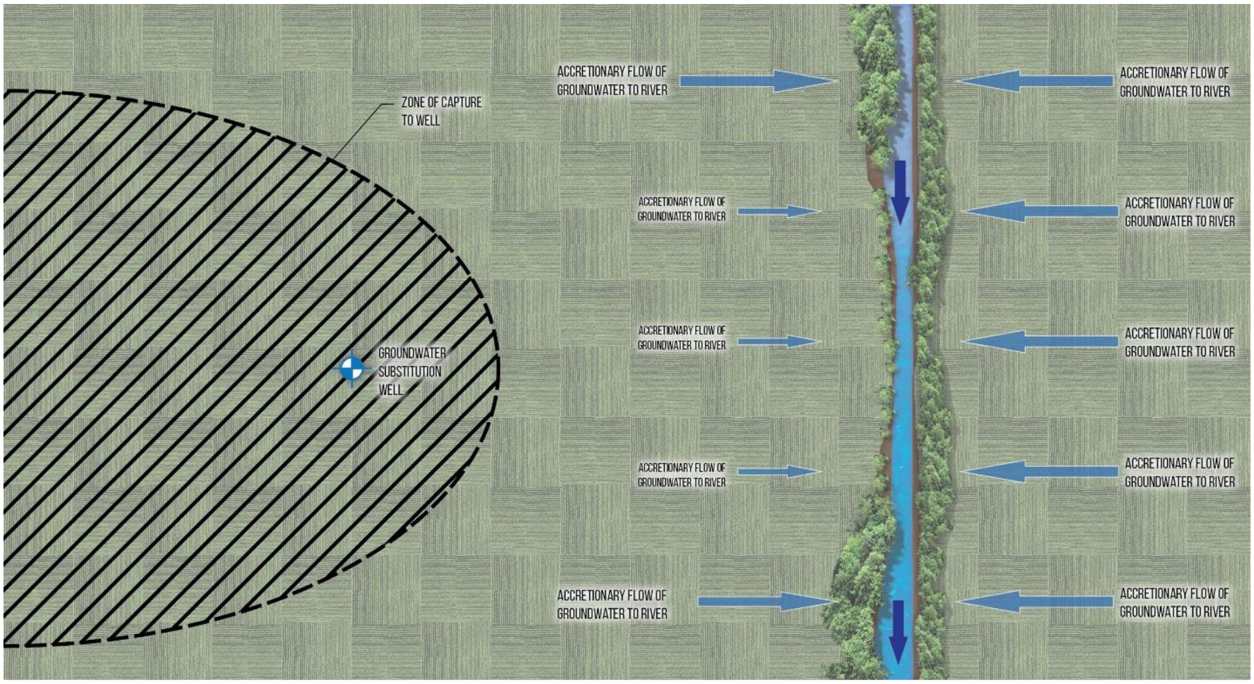

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Figure 5 Plan View of Extraction of Groundwater via a Groundwater Substitution Well from which the Zone of Capture to the Well Does not reach the River

Figure 5 illustrates that extraction pumping far back from a river's edge (e.g. perhaps more than 1-mile) does not capture water directly from the river but instead results in a loss of accretionary flow of groundwater to the river as depicted by the reduced accretionary flow arrows and the diminished riparian zone flora (and in all likelihood impacts the hyporheic fauna near and beneath the riparian zone that supports the food chain for pelagic fish such as salmonids and the habitat for other threatened species). The deprivation of flow to the river from a groundwater extraction well located some distance from the river is ultimately equal to the quantity of extraction; if the flow to the well is drawn from storage then that storage will be replaced eventually by an equivalent quantity of groundwater via direct recharge and indirect groundwater recharge. As Dr. Wenzel's comment notes the only water not deprived to the river or stream is that water that would otherwise have been withdrawn for consumptive use and evapotranspiration by vegetation that is/was able to utilize water from the zone of saturation (i.e. the water table aquifer).

Evaluation of the timing of streamflow depletion due to groundwater extraction wells was made simpler by a further paper by Dr. Theis and his co-author in 1963. The following graphic (Figure 6) describes the timing of impact to a stream or river's quantity of flow based upon two primary criteria, the ration of the aquifer storage coefficient to the aquifer transmissivity, S/T, and the distance between the extraction well and the river.[21] The coefficients are as described in the Explanation in the chart with the X-axis denoting the time since pumping began.

[21] Theis, C.V. and C.S Conover. 1963 "Chart for Determination of the Percentage of Pumped Water being Diverted from a Stream or Drain" *USGS Water Supply Paper 1545-C*. pp. C106-C109.

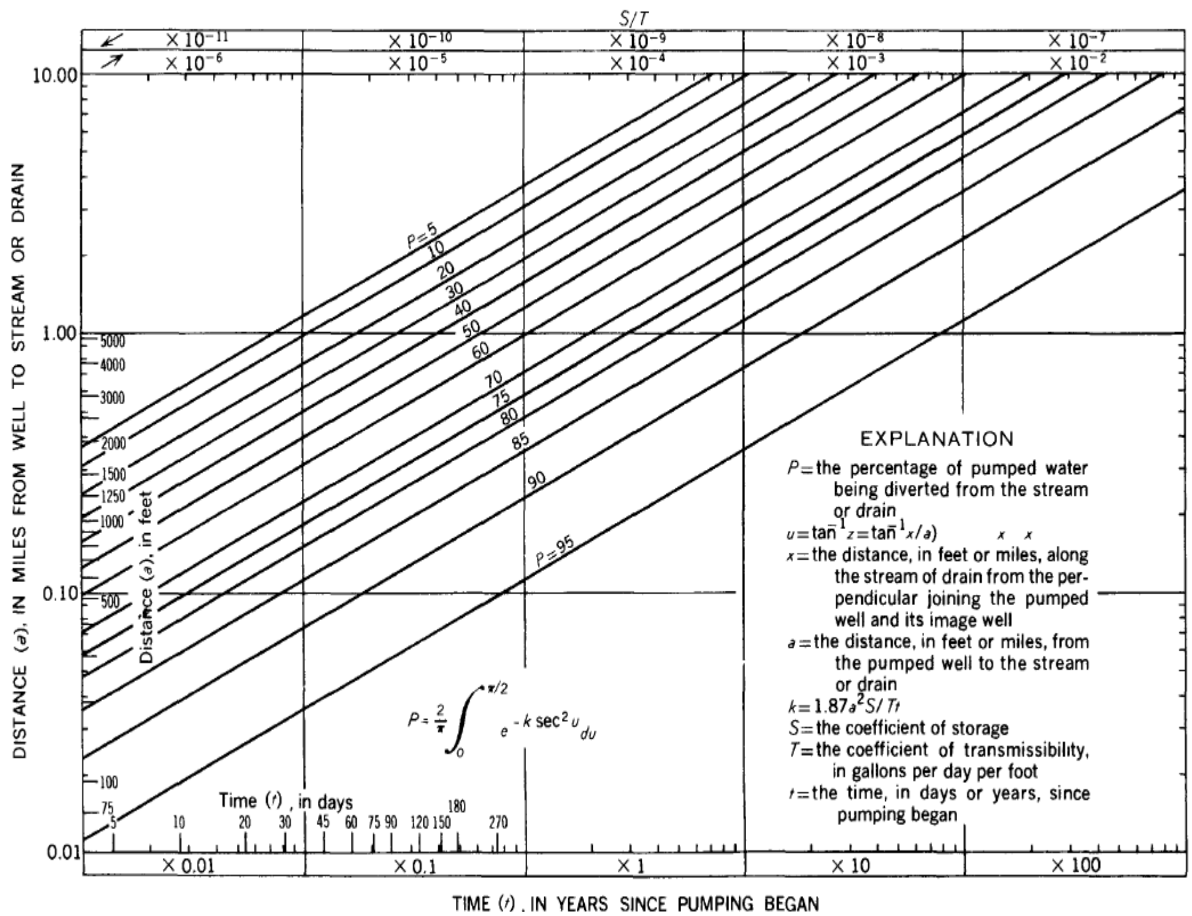

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Figure 6 Theis' graphic describing transmissivity and the distance between extraction wells.

FIGURE 30.—Chart for determination of the percentage of pumped water being diverted from a stream or drain.

This method of analysis was then added to by Mahdi Hantush in 1965 by incorporating to the mathematical solution a simplified concept of streambed resistance laterally to groundwater flow by way of a vertical layer of impedance to flow.[22]

This group of two general methods was improved upon further by Jenkins in 1968 in several ways but also in describing the residual effects of "streamflow depletion" (a phrase first coined in Jenkins paper) after pumping ceases. [23] Jenkins' addition to the field of groundwater and surface-water interconnection at river boundaries, enabled season-to-season carryover of depletions of groundwater storage and the resulting streamflow depletion that can take place over more than one annual hydrologic cycle. Wallace et al. (1990) carried out a similar analysis for cyclic pumping of wells.[24]

[22] Hantush, M.S., 1965. Wells near streams with semi-pervious beds. *Journal of Geophysical Research, v. 70*, no. 12: pp2829-2838

[23] Jenkins, C.T., 1968. Techniques for computing rate and volume of stream depletion by wells. *Ground Water, v. 6*, no. 2: pp 37-46.

[24] Wallace, R.B., Y. Darama, and M.D. Annable, 1990. Stream Depletion by Cyclic Pumping. *Water Resources Research v. 26*, no. 6, 1263-1270.

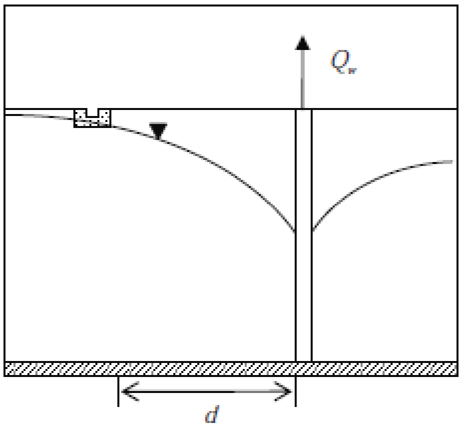


Figure 7 Definition Sketch for a partially penetrating well and a river with semi-pervious layer Hunt (1999)

Subsequently Bruce Hunt (1999) developed an analytical solution to the question of what is the response in a river that has a lower permeability streambed surrounding it than the permeability of the groundwater aquifer to which it is connected including the conceptualization of an extraction well which only partially penetrates the aquifer adjoining the stream.[25] While the bounding conditions of a homogeneous aquifer of infinite extent are applied to each of the aforementioned methods in order to solve the equations of unsteady flow in which a well or wells are actively extracting constitute an idealized case, the inclusion of a semi-pervious streambed fully to the solution provides an even more realistic estimate of the timing of impact on flow in a river or stream (Figure 7).

Lastly, Bruce Hunt (2003) developed an analytical solution to the case of a stream incised into a low permeability layer or formation over top of a more permeable aquifer (Figure 8).[26] 39

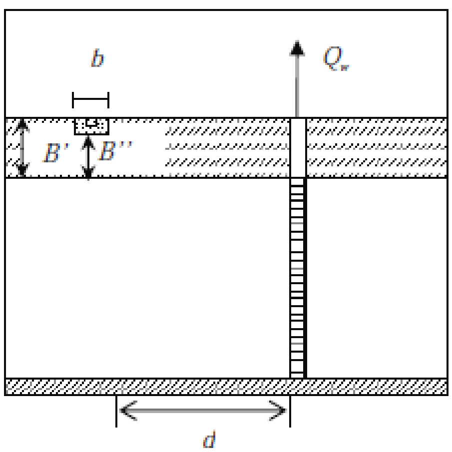


Figure 8 Definition Sketch for flow to well in semipermeable aquifer Hunt (2003)

Each of the four analytical mathematical solutions to the question of the impact of extraction well pumping on flow in a stream and the genesis of the water captured by an extraction well remain valid, particularly where the bounding assumptions are met well by the aquifer being pumped. Various mathematical solvers are available to look at streamflow depletion by the appropriate analytical method for each case including some provide by Dr. Bruce Hunt[27]; the most recent set of solvers for each of these groundwater to surface-water analytical methods was developed by the USGS (2008).[28] The USGS program STRMDEPL08 enables a sequence of time varying pumping during an irrigation season and it allows for year on year carryover of aquifer depletion to be retained in a subsequent year. This program represents "best available science" for near field assessment of groundwater extraction on the flow in nearby streams. Based upon the information provided in the EIS/EIR with regard to stream aquifer relationships our review determined that the conceptual model of Figure 7, Hunt (1999) best fits the conditions described for the Sacramento Valley. An evaluation of streamflow depletions for select wells near rivers was undertaken for the extended drought period of 1987 to 1992

[25] Hunt, B., 1999.. Unsteady stream depletion from ground water pumping. *Ground Water, 37*(1), pp. 98–102.

[26] Hunt, B. 2003. Unsteady Stream Depletion when Pumping from Semiconfined Aquifer. *Journal of Hydrologic Engineering, Vol. 8*, No. 1, pp. 12-19.

[27] http://www.civil.canterbury.ac.nz/staff/bhunt.asp

[28] Reeves, H.W., 2008,STRMDEPL08—An extended version of STRMDEPL with additional analytical solutions to calculate streamflow depletion by nearby pumping wells: U.S. Geological Survey Open-File Report 2008–1166, 22 p.

noted in the EIS/EIR was undertaken and the method and results are presented in Attachment A. These analyses result in a range of streamflow depletion factors (SDF) from in short-term SDF ranging from 8% to 22% by the end of a 1987 extraction scenario proffered in the EIS/EIR and long-term cumulative SDF ranging from 34% to 108.5% of annual pumping based on evaluation of the 6-year drought from 1987 to 1992 again following the extraction scenario proffered in the EIS/EIR due to the cumulative depletion of aquifer storage and the available accretionary flow of groundwater to the river as compared to stream flow from the river to satisfy the capture of water by a groundwater extraction well. 39

Assessment of SACFEM2013 Model for Water Supply Analysis in the Post Processing Tool

The SACFEM2013 model in the EIR/EIS does not account for the streamflow depletions induced by groundwater pumping along the lines of any of the analytical methods identified above from the literature. SACFEM2013 has no river flow accounting to account water flow depletions. As for potential impacts to surface water flow rates due to groundwater accretions or depletions SACFEM2013 does not account the quantity of water flowing within a river. There simply is no algorithm in the MicroFEM code to account for changing rates of streamflow and dynamically changing river stage associated with streamflow. Hence these potential impacts are not accounted in the SACFEM2103 model.[29] As a result of this missing algorithm in the model the outflow of surface water to groundwater in a river reach where Groundwater Substitution Measures lower the modeled head in the upper aquifer (ignoring the numerous errors in the formulation of well extractions and in the SACFEM2013 model hydraulic parameters)[30] below the river bottom water is not properly accounted in SACFEM2013. The loss of surface water flowing into the groundwater domain to satisfy the extraction well demand via streamflow depletion is not accounted. Thus the available Water Supply will not be properly accounted using SACFEM2013 with respect to both the magnitude of the impacts to Water Supply due to Groundwater Substitution pumping and the timing of such impacts to Water Supply and surface water flow in the rivers. This holds for extraction from any of the 327 groundwater extraction wells proposed as a part of Alternatives 2 and 3. This lack of water accounting affects the ability of the "post-processing tool" to properly evaluate water availability under Water Supply due to the shortcomings of the SACFEM2013 model to calculate changes in river flow. 40

Further as to the poor accounting of water available to the "post-processing tool," the river outflow is not accounted properly in the SACFEM2013 groundwater model at the river nodes. As mentioned under Groundwater Resources SACFEM2013 sets each river reach's stage height as invariant during a month, irrespective of the groundwater withdrawals. This river stage invariance means that SACFEM2013 calculates as though there is an infinite amount of water in the nearby river (i.e. no streamflow depletion impact on the predicted outflow of water). 41

[29] SACFEM2013's agricultural groundwater extraction terms were reportedly developed using the Irrigation Demand Calculator (IDC) within the California Dept. of Water Resources, Integrated Water Flow Model (simulation code). The use of only a portion of the IWFM, simulation code and the manner in which it was done leaves the soil moisture model and the groundwater model uncoupled with no feedback between the two models except that perhaps carried by the user from SACFEM back to the IDC model .

[30] SACFEM 2013 formulation places all extraction wells into Layers 2, 3, and 4 and then artificially imposes a vertical anisotropy of 500:1 at each flow layer.

The river inflow (i.e. gaining reaches) is calculated in SACFEM2013. However it is done inaccurately due to the invariant stage height during each monthly time step in the model. This imprecision results in an improper accounting of water. Not surprisingly the peer review for the model done in 2011 found:

> *"Review of the representative and other calibration hydrographs reveals that significant calibration issues exists in areas that rely mostly on surface water. This is mainly due to the issues of SacFEM's estimation of stream-aquifer interaction. Calibration quality improves in areas that rely mostly on groundwater."*[31] 42

Using this mathematical formulation in the algorithm for groundwater to surface water flux, the degree of exfiltration in each month from the river to groundwater is too high if flow and stage in the river decrease due to Groundwater Substitution Measures or alternatively the degree of exfiltration is too low if Water Transfer flows increase river stage during the transfer period of July to September as more of that water would be depleted from the stream and not available to the Buyer's Area. Thus inputs from SACFEM2013 to TOM for subsequent analysis of Water Supply, are inaccurate.

Review of SACFEM2013 by the aforementioned peer review found that SacFEM2013 deep percolation rates are not supported by the fundamental Irrigation Demand Calculation (IDC) module's methodology (a subcomponent of DWR's Integrated Water Flow Model, IWFM simulation code) and parameters. This results in a disconnection between SacFEM2013 and IDC. They recommended incorporating a feedback loop between the two models (IDC as constructed for SACFEM2013 input, and SACFEM2013) and subjecting them to convergence criteria. Their review states: 43

> *"SACFEM deep percolation rates are not consistent with other data sets and it should be ensured that they are supported by historical land use, crop mix, and agricultural practices."*

It is unknown whether these recommendations from 2011 to SACFEM2013 were incorporated to SACFEM2013 based on the documentation provided in the EIS/EIR and on the documents requested and received from the project proponents. Further review of SACFEM2013 is provided in Attachment C herein.

Lastly with regard to SACFEM2013 and Water Supply considerations we note that unlike Appendix B of the EIS/EIR on the uncertainties and limitations of TOM and CalSim II, there are no statements in Appendix D of the EIS/EIR or the main body of the EIS/EIR as to the uncertainties in the modeling assumptions or stated limitations on the utility and intended uses of the SACFEM2013 groundwater model.

Looking at "Best Available Science" for evaluation of potential impacts in the EIS/EIR there is a simulation code available from DWR, IWFM, which can better evaluate the time varying mass balance between surface water and groundwater inclusive of losses or gains in soil moisture to crop demand and precipitation. The IWFM simulation code's capabilities are summarized in Attachment B herein and documented for the current release by DWR.[32] However, the simulation code with these general capabilities was first publicly released in 2003. Further there is an existing model of the Central Valley in IWFM, C2VSim, which is calibrated for the period 1922 to 2009, which was initially released to the public in 2011. The C2VSim model can be run with either a coarse finite element grid (C2VSim-CG with 1,392 44

[31] WRIME. 2011. Peer review of Sacramento valley Finite Element Groundwater Model (SACFEM2013), October at page 16

[32] http://baydeltaoffice.water.ca.gov/modeling/hydrology/IWFM/IWFMv4_0/v4_0_331/downloadables/IWFMv4.0.331_TheoreticalDocumentation.pdf.

elements, run-time 6 minutes) or with a fine finite element grid (C2VSim-FG with over 35,000 elements, run-time 6 hours). For both versions, the elements are grouped into 21 water-budget sub-regions. [33] The C2VSim-CG model was utilized in our review to assess the cumulative impacts.[34] DWR notes that both C2VSim versions will also be useful tools for integrated regional water management plans, planning studies, groundwater storage investigations, assessing infrastructure improvements, evaluating ecosystem enhancement scenarios, conducting climate change studies, and assessing the impacts of 44
changes to water operations. The results of our assessment of relative streamflow depletions in several river reaches brought about by projected use of available transfer volumes in the extended drought of suggest that streamflow depletions of 8% to 22% depending upon the year and the river reach will result from a mass balanced model. In our review the use of C2VSim-CG provides a reasonable estimate of what best available science would reveal. Use of C2VSim-FG would likely improve upon the accuracy of the estimated streamflow depletions resulting from Groundwater Substitution Measures on Water Supply.

Assessment of the CalSim II Model for Water Supply Analysis in the Post Processing Tool

As stated previously for the No Action Alternative, the use of CalSim II has yielded significant scrutiny on its ability to provide relevant data to assess potential future impacts (Close, A. et al, 2003).[35] The CalSim
II model presented in the EIS was used for the baseline conditions (2014 planning horizon) and was not 45
used to assess potential changes resulting in future land use and hydrologic/metrological conditions. The baseline assessment can only assess how the Long-Term Transfer Project would impact the environment if it was in-place from 1970-2003 and therefore cannot assess potential impacts of future conditions that are different than the baseline conditions such as various climate change scenarios.

CalSim II does not provide adequate loss factors to assess potential project impacts. The CalSim II model describes the physical system (e.g., reservoirs, channels, pumping plants), basic operational rules (e.g., flood-control diagrams, channel capacity, evaporation, minimum flows, salinity requirements), and priorities for allocating water to different uses (water quality, ecosystems, etc.). As a result of CalSim II's
complexity, very important water loss characteristics such as stream reaches losses, deep groundwater 46
percolation, and stream-aquifer interactions are generalized as basin "efficiencies" rather than losses for specific reaches or stream-aquifer interactions. The lack of specific loss characteristics within CalSim II yields inaccuracies specific to even seasonal and annual water accounting losses (e.g., stream-aquifer interactions) that have been identified as potential impacts from the proposed Long Term Water Transfers.

[33] As reported by the DWR at http://baydeltaoffice.water.ca.gov/modeling/hydrology/C2VSim/index_C2VSIM.cfm on November 30, 2014

[34] Informal telephonic requests to DWR's Bay Delta Office for C2VSim-FG on November 13, 2014 revealed that they view the model as not ready yet for public release.

[35] Close, A., Haneman, W.M., Labadie, J.W., Loucks D.P. (Chair), Lund, J.R., McKinney, D.C., and Stedinger, J.R. (Close, A. et al.). Strategic Review of CALSIM II and its Use for Water Planning, Management, and Operations in Central California. Submitted to the California Bay Delta Authority Science Program Association of Bay Governments. Oakland, California. December 4, 2003.

Hydrology modeling within CalSim II uses a "depletion analysis" to estimate the historical and projected level flows (Ford 2006).[36] As a result of this, CalSim II requires a calculation to estimate the aggregate stream inflow for each sub-watershed. This calculation is identified as the "closure term" of the hydrologic mass balance and is also how the model encompasses errors resulting from over/under estimates of water losses. In recent documentation regarding future development of CalSim II into version III, DWR and Reclamation provided a graphic of "closure term" magnitudes. [37]

In this graphic from Draper 2008 (Figure 9), the "closure term" represents a significant amount of error in CalSim that has to be accounted for to create a hydrologic mass balance. Note that this graph is in thousands of acre-feet/year. Thus the "closure term" necessary to correct for water budget errors in CalSim ranges from (2,000,000) AFY in deficit to 3,000,000 AFY in surplus. CalSim II does not account for water on an annual basis with precision. 47

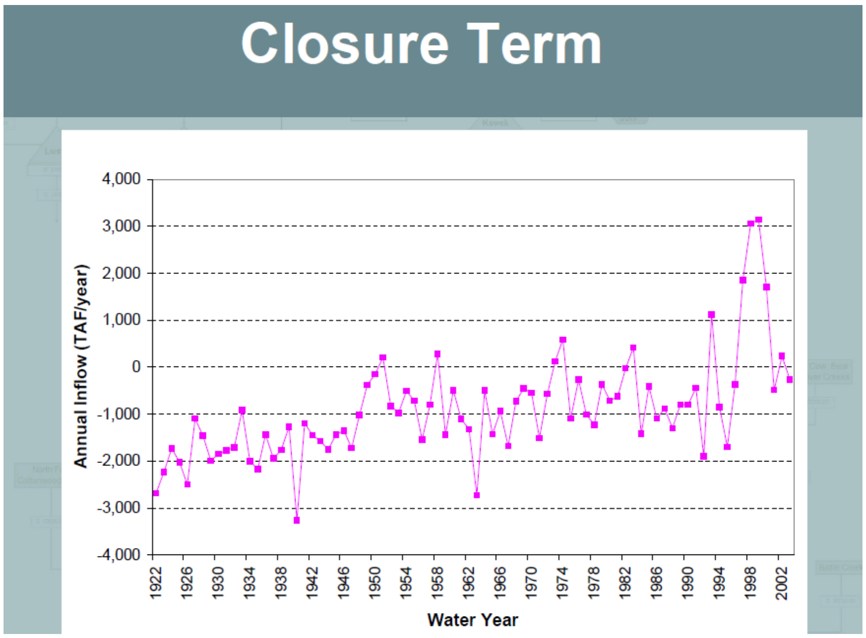


Figure 9 Closure Terms to Correct Accounting Problems in CalSim for Annual Quantities of Water

CalSim II cannot assess how "Long-Term" water transfers would impact future water demands, water supplies, and required water quality and ecosystem management requirements. Hence the analysis of potential impacts to Water Supply based upon CalSim II is insufficient. CalSim II does not provide adequate detail to assess project impacts. The very poor precision of the surface water delivery model (CalSim II) used for the baseline assessment on quantities of water moving in and around the CVP and SWP leads to problems in accounting for water losses due to existing and proposed groundwater extractions.

As noted in the review of CalSim II in Draper (2008) there is a version of CalSim referred to alternately as CalSim III or CalSim 3 that appears to have been in development and use since approximately 2006. 48

[36] Ford, D., Grober, L., Harmon, T., Lund, J.(Chair), McKinney, D. (Ford et al., 2006). Review Panel Report San Joaquin River Valley CalSim II Model Review. CALFED Science Program – California Water and Environment Modeling Forum. January 12, 2006.

[37] Draper, A. CalSim-III Hydrology Development Project, CalSim III Implementation, MWH Americas, California Water and Environmental Modeling Forum Annual Meeting, 2008

> *"The C2VSim-CG model is being used as the basis for the groundwater flow component of CalSim 3, and has also been used to investigate how Sacramento Valley water transfers may affect Delta flows and how an extended drought may impact groundwater levels."*[38]

It would appear that CalSim III represents "Best Available Science" with its focus on improving the significant shortcomings in CalSim II identified in our review and that of others. However, CalSim III was not utilized for the EIS/EIR. An analysis of the outcomes for the project by way of CalSim III use would appear to represent something approaching best available science on the available windows of water for transfer prior to 2003 and post 2003 to present and beyond. The availability and uses of CalSim III by USBOR for the CVP could not be determined during our review. 48

Assessment of the Transfer Operations Model for Water Supply Analysis in the Post Processing Tool

TOM was developed to analyze effects of the Long-Term Water Transfer Project on the CVP, SWP, major rivers, and the Delta. TOM does not provide a specialized groundwater, hydrology, or hydraulic simulations of the Long-Term Water Transfer Project but rather provides water accounting based upon inputs from SACFEM2013 and CalSim II. As a result of the water accounting approach, the inaccuracies within CalSim II (e.g., water losses, closure term error, etc.) and SACFEM2013 (e.g., stream-aquifer interactions, groundwater elevation predictions, etc.) are carried over into TOM to quantify and assess potential impacts resulting from the Long-Term Water Transfer Project. 49

Our review of the TOM model provided by the project proponents at our request yielded a number of errors that were also included in the EIS text. Table 1 presents two examples water transfer volumes that were presented in the EIS/EIR Executive Summary Table 2, EIS/EIR descriptive text of each text from section 3.1.1.3, and TOM. 50

Table 1 – Comparison of Transfer Volumes Within Long-Term Water Transfer Project Documentation

Transfer Description	Table ES-2 (AF)	EIS Section 3.1.1.3 (AF)	TOM (AF)
Anderson-Cottonwood Irrigation District (Maximum Groundwater Substitution Volume)	5,225	5,225	5,938
Garden Highway Mutual Water Company (Maximum Groundwater Substitution Volume)	14,000	12,287	14,000
Conaway Preservation Group (Maximum Cropland Idling or Crop Shifting Volume)	9,239	9,239	21,349

Upon review of Table 1, how specific transfer volumes of water are applied in TOM, CalSim II, and SACFEM2013 is neither understood nor constant. Additionally, specific model descriptions of how CalSim II, SACFEM2013 and TOM account for each water transfers are vague. The EIS states that there is a priority of transfer volumes *("…groundwater substitution and reservoir release are more likely transfer mechanisms than crop idling…",* Section B.4.3.1.2) but specifically how each transfer was applied to the

[38] As reported by the DWR at http://baydeltaoffice.water.ca.gov/modeling/hydrology/C2VSim/index_C2VSIM.cfm on November 30, 2014

50

time series and into each model are not documented. To understand how each transfer volume is applied in each model is essential to properly assess the validity of the analysis of potential impacts.

51

Within TOM, adjustments in delivered water through the Delta include a portion lost as carriage water which is defined as extra water needed to carry water across the Delta to export facilities. Carriage water is a critical part of the water modeling analyses because the additional water is needed to maintain Delta water quality. Because the majority of the transfer water is made available and diverted upstream of the Delta, TOM assumes carriage percentage adjustments based on the location of the transfer:

- Transfers from the Sacramento River assume a 20 percent carriage water adjustment;
- Transfers to Contra Costa Water District assume a 20 percent carriage water adjustment;
- Transfers from Merced Irrigation District assume a 10 percent carriage water adjustment for water flowing from the San Joaquin River into the Delta.

The use of a single carriage percentage based on location does not adequately address potential impacts to Delta water quality. The concept of carriage water is a complex concept that would require appropriate hydrodynamic models coupled with a hydrology and groundwater model to identify appropriate carriage water volumes over time. The EIS states that the initial estimates for carriage water should later be verified and adjusted and therefore water quality impacts cannot be assessed with the models presented in the EIS/EIR for Long-Term Water Transfers. Additionally, significant stream flow depletion associated with pumping will likely reduce water transfers to the Delta and result in significant water quality impacts and/or limited transfers to water buyers. Therefore, statements with the EIS/EIR claiming limited changes in Delta outflow as well as water quality impacts are unfounded.

52

Carryover of storage water within reservoirs is one of many factors within the EIS/EIR, TOM and CalSim II that lacks a description of application. In other words there is no detail provided on where each of the water volumes in TOM are derived (e.g. groundwater vs. stored water). As a result of streamflow depletion from Groundwater Substitution Measures, the EIS/EIR identifies that small decreases in water supplies to users could occur when the stored reservoir release transfers decrease carryover storage in reservoirs. These operational controls are very important to how storage facilities would operate during extended dry periods. These operational assumptions within the modeling are not described in the EIS/EIR text or models. Therefore, carryover along with other operational assumptions associated with the Long-Term Water Project is not properly assessed and the resulting operational Water Supply impacts could be significant; these potential and probable impacts to Water Supply are not analyzed in the EIS/EIR for Groundwater Substitution Measures.

Summary of Impact Assessment

53

Impacts to Water Supply from the Water Operations Assessment are not fully quantified. The improper accounting of water under Groundwater Substitution Measures results in insufficient control on water accounting such that water lost from river flow due to both the impairment of accretionary groundwater flow to support Project operations and the direct losses from river flow to groundwater extraction wells in the Groundwater Substitution program may be counted twice or more. Evaluation of the effects on Water Supply from the Groundwater Substitution Measures requires adequate and accurate analysis of what the sources of water in Water Supply and what appropriate streamflow depletions are for

Groundwater Substitution Measures on top of existing conditions to assess short-term and long-term effects on Water Supply from Long-Term Water Transfers. Further the use of Groundwater Substitution 53 Measures has important impacts to Water Supply in regard to operational flexibility. These have been rated to be Less Than Significant in the EIS/EIR but given the substantive errors noted in assessing available water for Long-Term Water Transfers this likely deserves re-examination.

Proposed Mitigation

Due to the improper accounting of water in Water Supply, the proposed mitigation WS-1 is inadequate to mitigate the likely impacts to water availability and water flows into and through the Delta during 54 three important periods of time: (1) the period of Groundwater Substitution pumping, April thru September; (2) the Water Transfers window, July thru September; and, (3) the period following the Water Transfers window, October to April.

The Proposed Mitigation WS-1 to address streamflow depletion resulting from Groundwater 55 Substitution Measures is ill defined and will not adequately mitigate the impacts to Water Supply.

Due to the lack of a specific formulation for the proposed Water Supply mitigation, WS-1, it is unpredictable how the mitigation will be applied. The EIS/EIR references Draft documents on Technical Information for Preparing Water Transfer Proposals (October 2013).[39] Those documents identify the need for estimating the effects of transfer operations on streamflow and describe the use of a streamflow depletion factor; however they provide no basis for Project Agency approval nor for transfer 56 proponents to submit site-specific technical analysis supporting a streamflow depletion factor. That document which is completely relied upon in establishing proposed mitigation, WS-1, states that:

> *"Project Agencies are developing tools to more accurately evaluate the impacts of groundwater substitution transfers on streamflow. These tools may be implemented in the near future and may include a site-specific analysis that could be applied to each transfer proposal."*[40]

This future action provides no established or predictable basis for the mitigation of streamflow depletions due to Groundwater Substitution Measures. Due to the improper accounting of water in both the groundwater and surface water supply models utilized for Water Supply analysis, reliance upon these models or the analysis in this EIS/EIR by the Project Agencies would result in inappropriate estimation of the streamflow depletion factors utilized. Examples of best available science 57 methodologies for quantifying streamflow depletion factors for Water Supply are provided in Attachment A . They result in short-term streamflow depletion factors ranging from in short-term SDF ranging from 8% to 22% of the Groundwater Substitution Measures proposed in the EIS/EIR and long-term cumulative SDF ranging from 34% to 108.5% of annual pumping based on evaluation of the 6-year drought from 1987 to 1992

The mitigation proposed for loss of Water Supply, WS-1, due to Groundwater Substitution transfers is insufficient. It does not adequately account for the impact from the resulting reductions of water 58 available in the rivers and groundwater due to the improper accounting of water in the EIS/EIR analyses.

[39] Department of Water Resources and Bureau of Reclamation, 2013. DRAFT Technical Information for Preparing Water Transfer Proposals – Information to Parties Interested in Making Water Available for Water Transfers in 2014, October.
[40] Ibid, at p. 33.

As detailed in our analysis the mitigation measure proposed has no basis in fact, and if it did the project proponents would find that mitigation of the impacts from Groundwater Substitution Measures are not likely to meet the Project Purpose and Need and the Project Objectives. 58

Water Quality

Groundwater Substitution Measures for Long-Term Water Transfers effects on Delta outflows and water quality are not properly considered in the EIR/EIS. The EIS/EIR rates the effects on Delta outflows and the impact to Delta Water Quality as Less Than Significant based on improper accounting of water. The effects and impacts are likely to be Significant and thus will require mitigation. 59

Potential Impact Statements from Table ES-4	Related Alternative(s)	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Water transfers could change Delta outflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS

The analysis of Environmental Consequences/Environmental Impacts is not done accurately nor with a complete conceptual model of the interactive groundwater and surface water system depletions that would affect the Federal and State water projects, CVP and SWP, to meet Water Quality requirements. As noted previously the analysis of components for Water Supply is improperly conceptualized and yet finds that streamflow depletion of significance can occur and must be mitigated by application of an appropriately calculated SDF.

Again from page 3.1.6 in Section 3.1.2.4.1 the EIS/EIR states: 60

> *"Transfers would not affect whether the water flow and quality standards are met…" but only Reclamation and DWR water supplies"*

The EIS/EIR anticipates hypothetically that if the streamflow depletion resulting from Groundwater Substitution Measures results in decreased river flows then USBOR and DWR would modify operations by decreasing Delta exports or release of additional water from reservoirs to meet Delta outflow and/or water quality standards; however as documented in Attachment D herein the Federal and State projects were unable to maintain these standards in 2013 due to dry year conditions and a lack of available in-stream flow and releases of water.

Under Assessment Methods at page 3.2-27 in Section 3.2.2.1.1 states that quantitative analysis relies on hydrologic modeling estimated changes in river flow rates and reservoir storage for the CVP and SWP reservoirs and the rivers they influence. The quantitative analysis is left to Appendix B but the main body states that: 61

> *"If the changes are small and within the normal range of fluctuations (similar to the No Action/No Project Alternative) for that time period, it is … assumed that any water quality impacts would be less than significant"*

According to the EIS/EIR:

> *"CalSim II is the latest version of CalSim available for general use. It represents the Central Valley with a node and link structure to simulate natural and managed flows in rivers and canals. It generates monthly flows showing the effect of land use, potential climate change, and water operations on flows throughout the Central Valley."* [41]

With Closure Terms to rectify storage and flow on the order of millions of acre-feet per year (as much as 3,000,000 AFY during the model periods simulated for the EIS/EIR), CalSim II is not an adequate tool for assessing whether flow and required storage changes under the proposed Groundwater Substitution 61
Measures are small, normal or significant to enable the assumption of insignificant water quality impacts. Further CalSim II works on a coarse monthly time-step to assess SWP and CVP operations. However, water quality and ecosystem management decisions require a more detailed weekly or daily time-steps to properly account for potential water availability and timing impacts. CalSim II is not the appropriate modeling system to assess the Long-Term Transfer Project which will cause daily flow changes that require water quality and ecosystem management decisions to mitigate impacts before they occur and does not represent best available science (see earlier comment on CalSim III under Water Supply).

Contracted Reservoir Releases by the Sellers may be diminished by streamflow depletions from current pumping conditions in areas where groundwater saturation falls below the river stage adjoining under existing conditions. These depletions of water available for transfer via Reservoir Releases and are not quantified in the EIS/EIR. The effect of these baseline conditions impacts the availability of water to be 62
transferred down the Sacramento River and through the Sacramento San-Joaquin Rivers Delta to the CVP and SWP pumping stations that pump water south via their respective aqueducts, the Delta-Mendota Canal, and the California Aqueduct.

The quantitative analysis of potential Water Quality impacts to the Sacramento-San Joaquin Delta is provided in Appendix C. Appendix C states at page C-2 that:

> *"The Delta Conditions analysis is performed with the Delta Simulation Model 2 (DSM2). DSM2 setup relies on the output of three additional tools for this Project: CalSim II, the Transfer Operations Model (TOM), and the Delta Island Consumptive Use model (DICU model). CalSim II outputs simulating California's water delivery system to the Delta are used* 63
> *to supply inflow and export boundary conditions to DSM2."*

Use of a CalSim II model with monthly outputs that are crude approximations of actual system performance at best renders use of these outputs to create daily approximations that are supplied to DSM2 useless in assessing the potential for water quality impacts from proposed Groundwater Substitution Measures that will impair the actual timing of surface-water baseflow as a result of streamflow depletion and the quantity of water available to meet Delta Water Quality requirements.

Proposed Mitigation

Our review finds that the Less Than Significant assessment in the EIS/EIR lacks sufficiently accurate analysis as to available flows and storage of water in the Sacramento River watershed by virtue of the 64
precision of the models used in the quantitative assessment. Mitigation is likely required to assure

[41] EIS/EIR Public Draft Under Review at page C-5

sufficient baseflow and stored water availability for CVP and SWP operating requirements for Water 64
Quality.

Terrestrial Resources

Potential Impact Statements from Table ES-4	Related Alternative(s)	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Groundwater substitution could reduce stream flows supporting natural communities in small streams	2, 3	S	GW-1	LTS

Assessment methods in the EIS/EIR for riparian, wetland, and natural in-stream community (e.g. fauna in the hyporheic zone such as Caddis fly larvae) impacts include SACFEM2013. Reportedly SACFEM2013 predicted changes in groundwater elevations over time were used to assess the potential impacts of groundwater depletion on stream flows in small tributaries and associated natural communities. However, it should be noted that in wetland and riparian habitats, groundwater typically ranges from eight feet to just below the ground surface Faunt (2009).[42] As noted previously under the discussion of Groundwater Resources evaluations, SACFEM2013 contains an unusual model construction feature using model "Drains" with respect to riparian habitats consumptive use of water, its evapotranspiration of water, and groundwater discharge to land surface outside of a recognized and model surface water course. Drains were set at land surface rather than at root zone depth. Thus SACFEM2013 is highly imprecise in its ability to discern where and how much a riparian or riverine habitat is utilizing groundwater or residual soil moisture (see earlier commentary on the decoupling of the soil moisture 65
model from the SACFEM2013 groundwater model)

The EIS/EIR notes that:

> *"…groundwater modeling results indicate that shallow groundwater is typically deeper than 15 feet in most locations under existing conditions, and often substantially deeper…"*[43]

Modeling is not the best available science for this analysis when empirical data are available to assess actual or anticipatable depth to a phreatic surface or the capillary fringe of water rising above the phreatic surface in native sediments and soils. For example groundwater elevations of Spring 2013 depicted on Figure 3.3-4 along the Sacramento River main stem from Red Bluff, California to roughly Princeton, California are above the streambed elevations. This indicates that the Sacramento River is gaining flow from accretionary flows of groundwater in this lengthy reach, and the phreatic surface of groundwater would be expected to be eight feet or less below ground surface along the riparian corridor of the river with possible wetlands. Similarly groundwater elevations depicted on Figure 3.3-4

[42] Faunt, C.C., ed., 2009, Groundwater Availability of the Central Valley Aquifer, California: U.S. Geological Survey Professional Paper 1766, 225 p

[43] EIS/EIR Public Draft at page 3.8-32

along the Feather River from Oroville to Live Oak are above the streambed elevations. Conditions for the riparian corridor and potential wetlands may exist based on these data. The areas where groundwater elevations are below the elevation of the bottom of river courses was noted in the discussion of Groundwater Resources; yet an analysis of near river and stream course depths to groundwater or the 65 capillary fringe can be reasonably estimated from the data. Data are better than models for current or historic conditions analysis.

Terrestrial Resource impacts are not properly accounted in the EIS/EIR due in part to the imprecision and inability of the models to assess dehydration of the soils and groundwater aquifer adjoining streams and large rivers.

Proposed Mitigation

Proposed Mitigation GW-1 is not quantified or quantifiable as to what groundwater pressure decreases will constitute an impact to natural communities in and near small streams in the Seller Service Area.

The groundwater elevation changes within a conceptual monitoring plan that would be necessary to mitigate stream flows supporting natural communities in small streams under proposed mitigation, GW- 66 1, must be quantifiable or else the proposed mitigation is insufficient to reduce the impacts from Groundwater Substitution Measures. The proposed mitigation, GW-1, is not sufficiently quantified in the EIS/EIR nor in the Groundwater Management Plans (GWMPs) referenced. Existing GWMPs do not contain quantified year on year metrics for subbasin depletion and refill within acceptable ranges to sustain primary functions like support for natural communities.

Potential Impact Statements from Table ES-4	Related Alternative(s)	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Transfer actions could alter flows in large rivers, altering habitat availability and suitability associated with these rivers	2, 3, 4	LTS	None	LTS

Much of the discussion of small streams is applicable to large rivers. Additional considerations are noted in the following discussion that demonstrate a finding of Less Than Significant is apparently due to a faulty analysis of the type of impacts, and their foreseeable magnitude and likelihood of creating Significant impact to habitat supported by large rivers.

Water transfers would affect flows in the rivers and creeks adjacent to and downstream of the areas 67 where transfer activities (of all kinds) would occur. Changes in stream flows that would result within the Seller Service Area may affect natural communities, such as riverine, riparian, seasonal wetland, and managed wetland natural communities, which are reliant on CVP and SWP operational outcomes with Water Transfers such as surface-water flow velocity, surface-water quality (in particular water temperature both released and exchanged with groundwater), and the accretion or depletion of

groundwater near surface. These operational outcomes and effects could propagate downstream of the 67
areas/locations where pumping occurs.

The extraction scenarios proffered in the EIS/EIR will cumulatively over time and space reduce the available accretionary flow of groundwater to the large rivers in addition to the loss of water directly
from the adjoining large river, where proximate to a well or wells, to satisfy the capture of water by 68
groundwater extraction wells used for Long-Term Water Transfers as Groundwater Substitution Measures.

Releases of storage water within reservoirs is one of many factors within TOM and CalSim II that lack a sufficient description for the analyses required here for natural habitat flow requirements. An adequate form of model would incorporate anticipated timing of natural flow impacts and controlled releases for Water Transfers. Again the best available science would include implementation of the IWFM simulation code to an appropriately configured model. Due to the IWFM codes ability to account stream flows dynamically in the simulation code's algorithms the timing and magnitude of flows could be quantified.
From this foundational quantification additional models on river flow velocities, bed scour, 69
temperatures and other attributes of Seasonally Varying Flow (SVF) that has been found to be essential to riverine habitat.[44] In other words there is no detail provided on where each of the water volumes in TOM are derived (e.g. groundwater vs. stored water). As a result of streamflow depletion from Groundwater Substitution Measures, the EIS identifies that small decreases in water supplies to users could occur when the stored reservoir release transfers decrease carryover storage in reservoirs. These operational controls are very important to how storage facilities would operate during extended dry periods.

Proposed Mitigation

A reanalysis of the potential impacts of Water Transfers is required using best available science to 70
ascertain the magnitude of potential impacts, system operational constraints on those impacts, and the method and implementation of mitigation, if needed.

Fisheries

The findings of Less Than Significant for Fisheries is not supported by the analytical tools based upon the preceding analyses of Groundwater Resources and Water Supply and should be revisited as to
availability of water to support riparian and hyporheic zones along the waterways for habitat support for 71
species of special interest identified in Section 3.7.1.2 and as to timing and quantity impacts of river flows due to streamflow depletions evaluated under Water Supply.

[44] Risley, John, Wallick, J.R., Waite, Ian, and Stonewall, Adam, 2010, Development of an environmental flow framework for the McKenzie River basin, Oregon: U.S. Geological Survey Scientific Investigations Report 2010-5016, 94 p.

ATTACHMENT A

STREAMFLOW DEPLETION CALCULATIONS USING USGS STRMDEPL08 FOR SELECT GROUNDWATER SUBSTITUTION TRANSFER WELLS

Development of Streamflow Depletion Factors for Select Wells

The USGS released in 2008 a numerical code, STRMDEPL08, that solves the analytical solutions of Theis, 1941, Hantush 1954, Hunt 1999, and Hunt 2003 for groundwater interaction with nearby streams. One of the key advantages to STRMDEPL08 is the ability to use time varying flow rates and shorter time steps down to one half of a calendar month.

Six wells in close proximity to streams based upon the input arrays provided for SACFEM2013. The distance to the nearest stream or river was calculated in GIS to the polylines for surface water bodies provided in response to the Delta Water Agency for model input datasets. This was generally found to be a greater distance than represented by the nodal structure of surface water nodes in SACFEM2013 vs. the groundwater extraction well nodes. Hence this is a conservative estimate of configuration with regard to expected streamflow impact (the distance of an extraction well from a stream is a key determinant in the timing and magnitude of the streamflow depletion)

Streambed thickness was set at 1 meter per the model documentation. Stream widths were as provided. Additionally the streambed vertical conductivity was as specified in the SACFEM2013 model dataset. These values were found to range from 1 meter/day to 0.1 meter/day which does not correspond to the Appendix D documentation but was used anyway.

The pumping stress was applied for the extended drought period of 1987 to 1992 for each well. The pumping rate applied for each well was derived from the information provided by the Bureau of Reclamation for their TOM operational analysis model. The total water available for extraction and transfer by the six entities (Sellers) for which a well was evaluated was used. The rate for the well was estimated by dividing the total quantity transferable by the number of wells owned (e.g. Pelger Mutual Water Company). It was then further modified by applying an estimate of Evapotranspiration on the average climatic zone of Yuba City. Groundwater extraction was thereby curved from April to September, the period of water demand for crops in that climate.

The results for 6 wells are depicted on the following pages, first by fraction of annual pumping per month, and then by cumulative extraction by pumping year. The carryover of depletions produces cumulative losses of more than 100% in certain years based upon the annual variability in pumping rates.

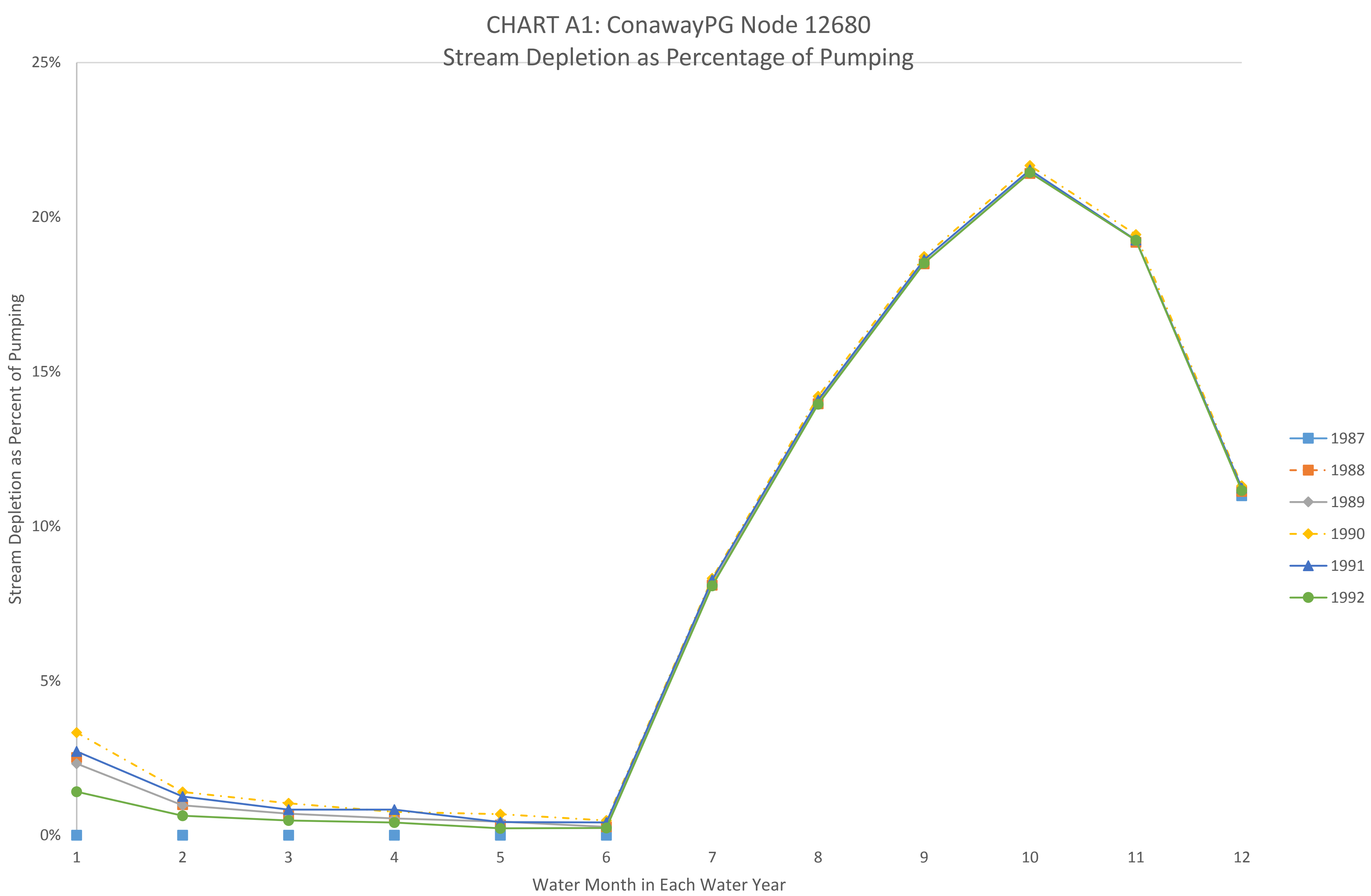


CHART A1: ConawayPG Node 12680
Stream Depletion as Percentage of Pumping
Stream Depletion as Percent of Pumping
25%
20%
15%
10%
5%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Water Month in Each Water Year
1987
1988
1989
1990
1991
1992

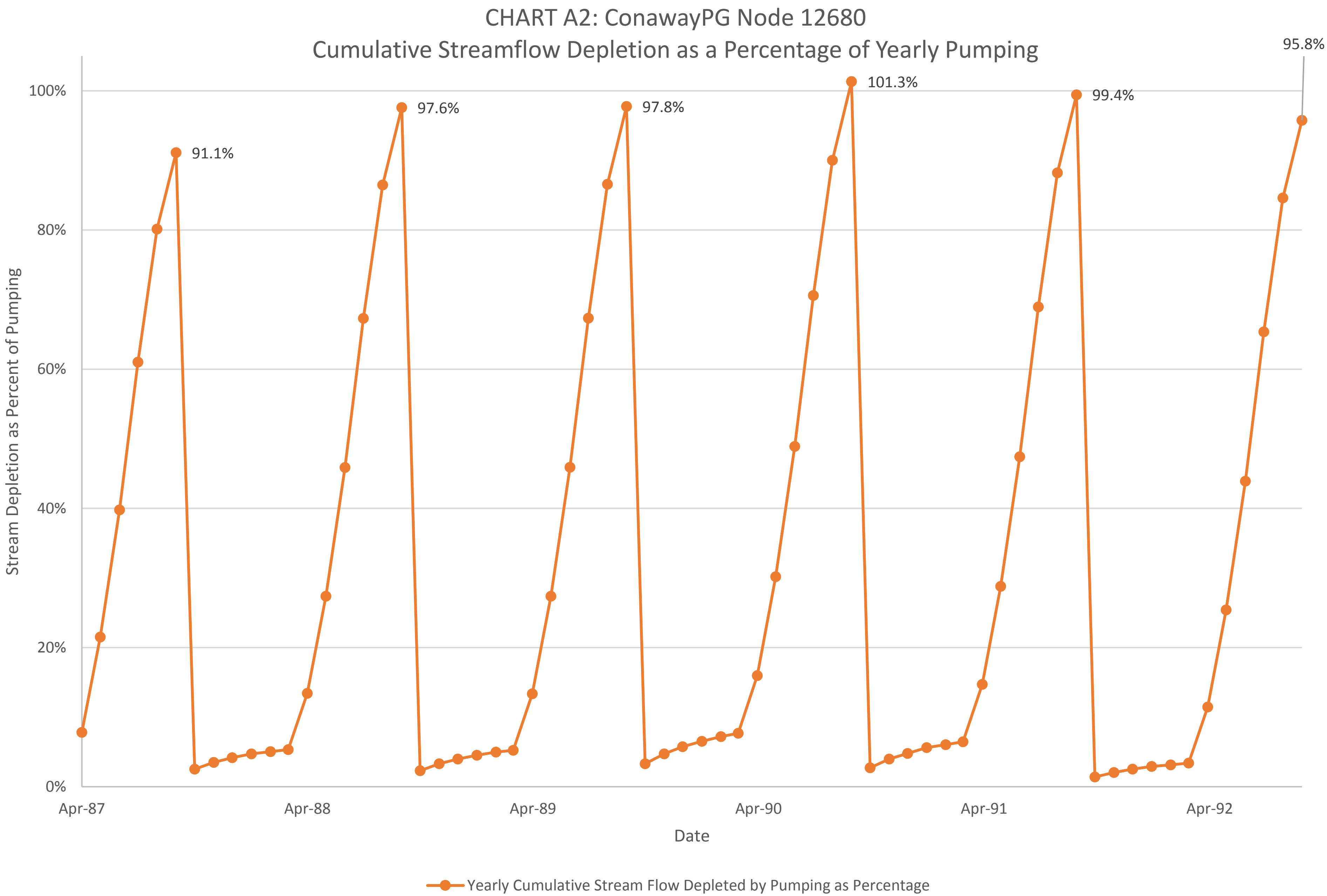


CHART A2: ConawayPG Node 12680
Cumulative Streamflow Depletion as a Percentage of Yearly Pumping
Stream Depletion as Percent of Pumping
100%
80%
60%
40%
20%
0%
91.1%
97.6%
97.8%
101.3%
99.4%
95.8%
Apr-87
Apr-88
Apr-89
Apr-90
Apr-91
Apr-92
Date
Yearly Cumulative Stream Flow Depleted by Pumping as Percentage

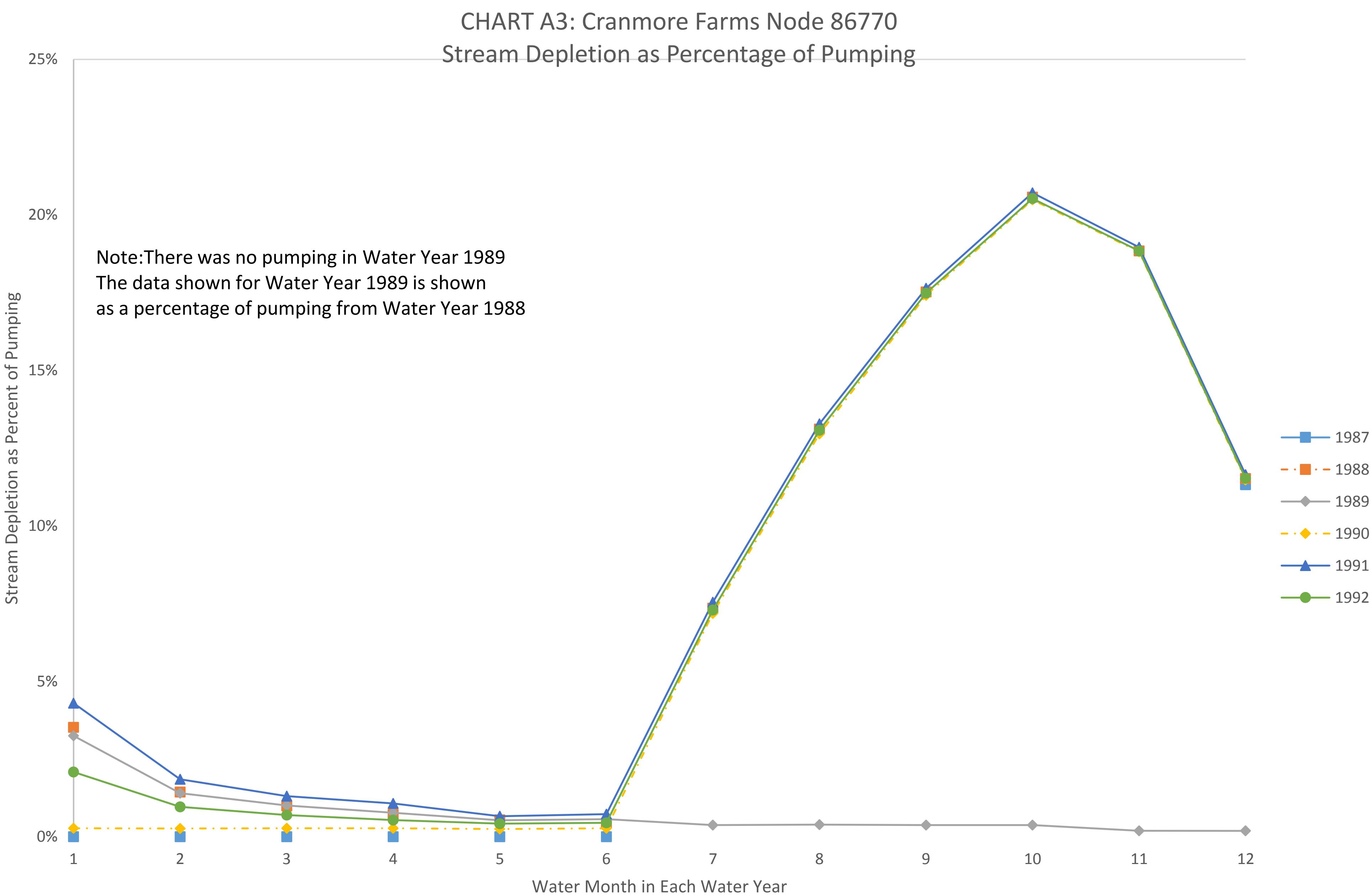


CHART A3: Cranmore Farms Node 86770
Stream Depletion as Percentage of Pumping
Note:There was no pumping in Water Year 1989
The data shown for Water Year 1989 is shown
as a percentage of pumping from Water Year 1988
Stream Depletion as Percent of Pumping
25%
20%
15%
10%
5%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Water Month in Each Water Year
1987
1988
1989
1990
1991
1992

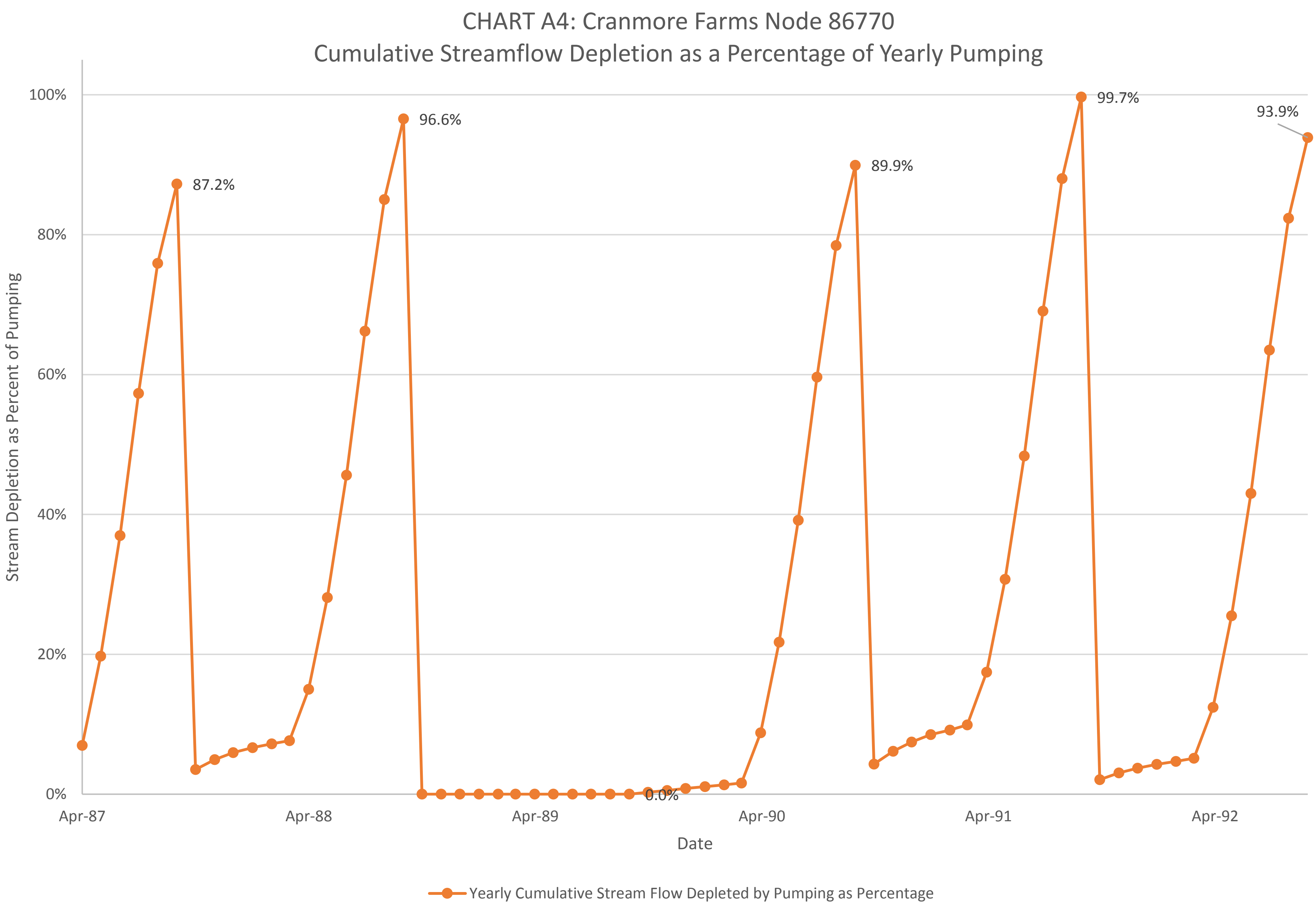


CHART A4: Cranmore Farms Node 86770
Cumulative Streamflow Depletion as a Percentage of Yearly Pumping
Stream Depletion as Percent of Pumping
100%
80%
60%
40%
20%
0%
87.2%
96.6%
0.0%
89.9%
99.7%
93.9%
Apr-87
Apr-88
Apr-89
Apr-90
Apr-91
Apr-92
Date
Yearly Cumulative Stream Flow Depleted by Pumping as Percentage

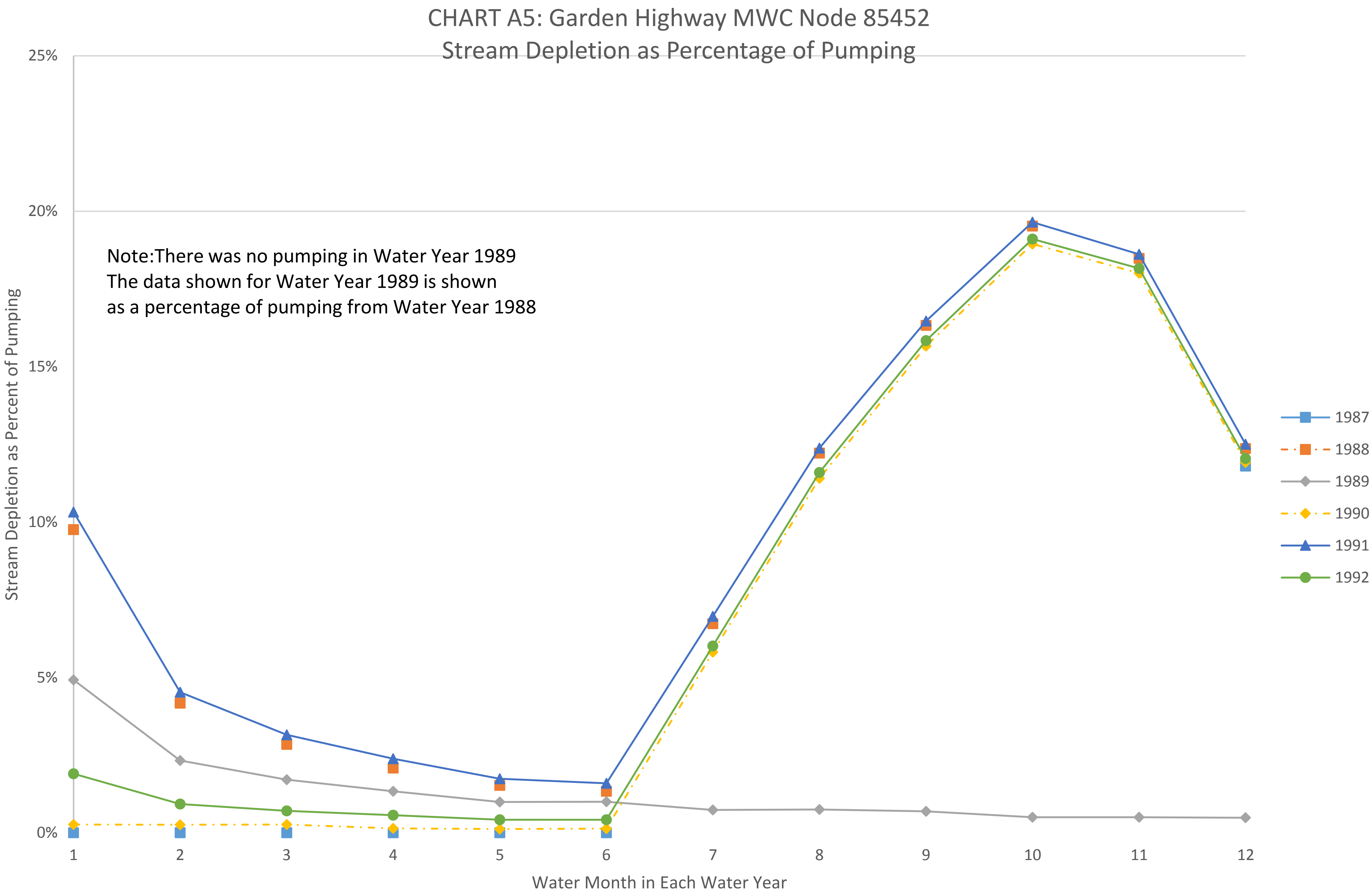


CHART A5: Garden Highway MWC Node 85452
Stream Depletion as Percentage of Pumping
Note:There was no pumping in Water Year 1989
The data shown for Water Year 1989 is shown
as a percentage of pumping from Water Year 1988
Stream Depletion as Percent of Pumping
25%
20%
15%
10%
5%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Water Month in Each Water Year
1987
1988
1989
1990
1991
1992

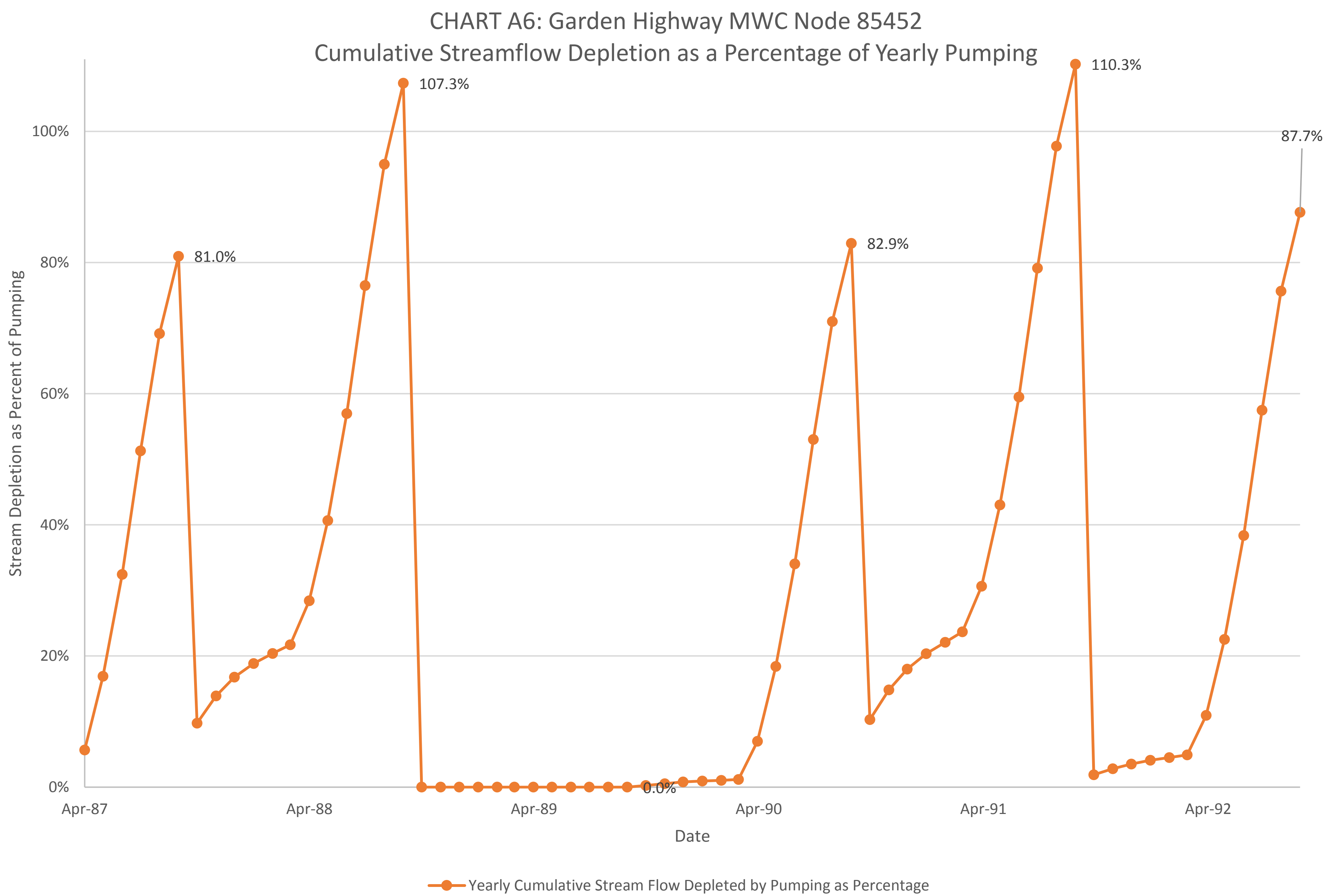


CHART A6: Garden Highway MWC Node 85452
Cumulative Streamflow Depletion as a Percentage of Yearly Pumping
Stream Depletion as Percent of Pumping
100%
80%
60%
40%
20%
0%
81.0%
107.3%
0.0%
82.9%
110.3%
87.7%
Apr-87
Apr-88
Apr-89
Apr-90
Apr-91
Apr-92
Date
Yearly Cumulative Stream Flow Depleted by Pumping as Percentage

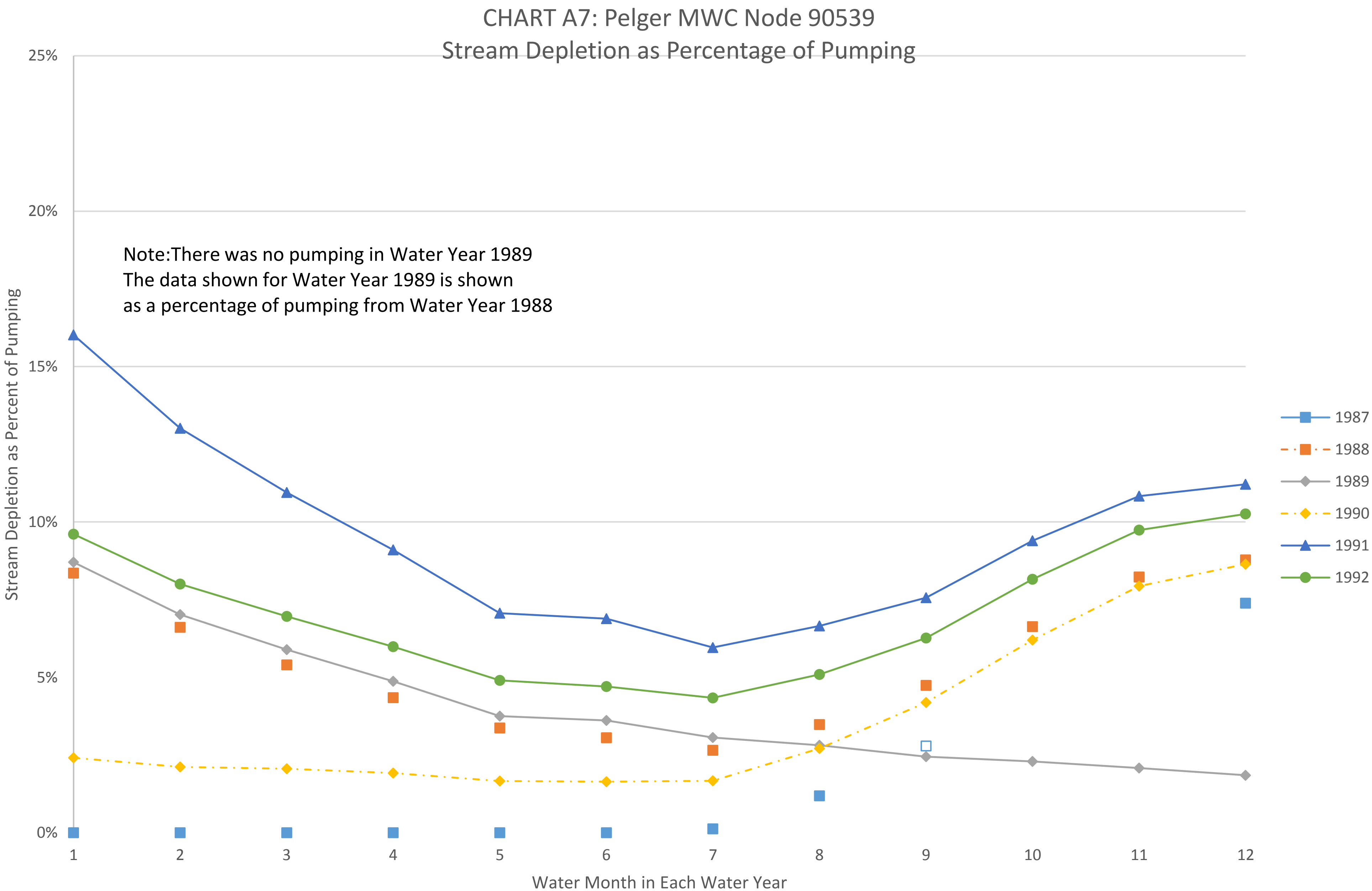


CHART A7: Pelger MWC Node 90539
Stream Depletion as Percentage of Pumping
Note:There was no pumping in Water Year 1989
The data shown for Water Year 1989 is shown
as a percentage of pumping from Water Year 1988
Stream Depletion as Percent of Pumping
25%
20%
15%
10%
5%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Water Month in Each Water Year
1987
1988
1989
1990
1991
1992

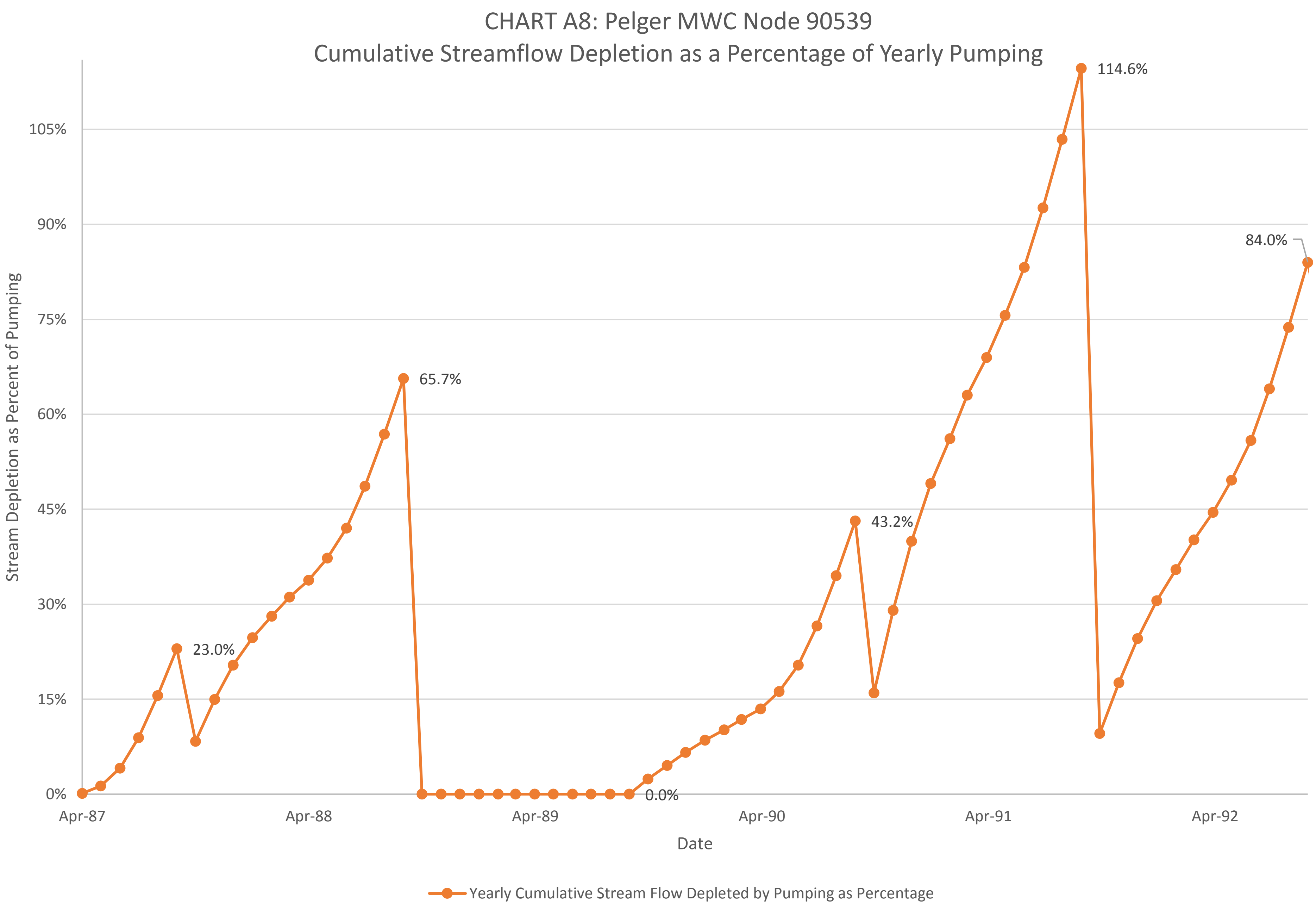


CHART A8: Pelger MWC Node 90539
Cumulative Streamflow Depletion as a Percentage of Yearly Pumping
Stream Depletion as Percent of Pumping
0%
15%
30%
45%
60%
75%
90%
105%
23.0%
65.7%
0.0%
43.2%
114.6%
84.0%
Apr-87
Apr-88
Apr-89
Apr-90
Apr-91
Apr-92
Date
Yearly Cumulative Stream Flow Depleted by Pumping as Percentage

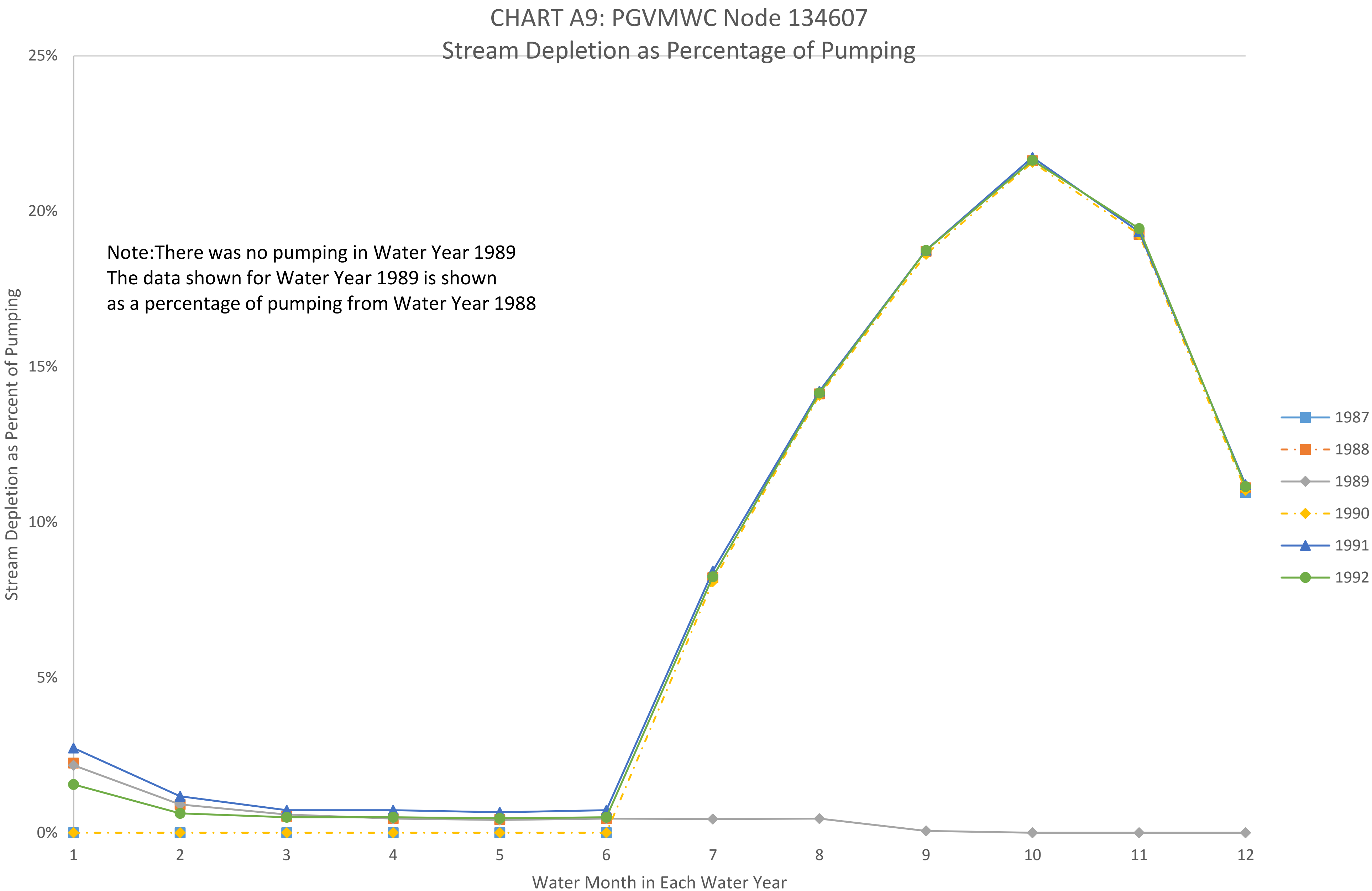


CHART A9: PGVMWC Node 134607
Stream Depletion as Percentage of Pumping
Note:There was no pumping in Water Year 1989
The data shown for Water Year 1989 is shown
as a percentage of pumping from Water Year 1988
Stream Depletion as Percent of Pumping
25%
20%
15%
10%
5%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Water Month in Each Water Year
1987
1988
1989
1990
1991
1992

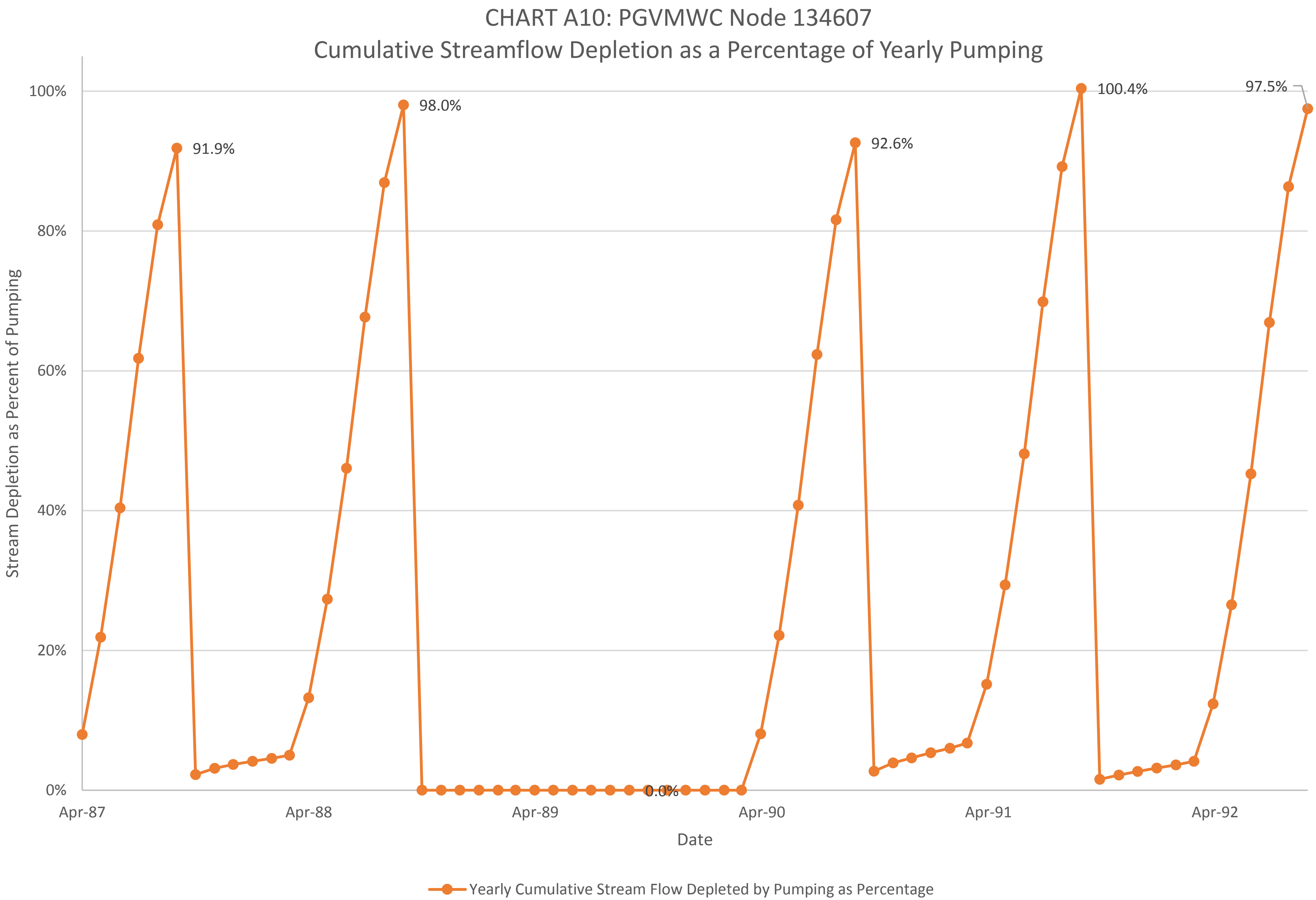


CHART A10: PGVMWC Node 134607
Cumulative Streamflow Depletion as a Percentage of Yearly Pumping
Stream Depletion as Percent of Pumping
100%
80%
60%
40%
20%
0%
91.9%
98.0%
0.0%
92.6%
100.4%
97.5%
Apr-87
Apr-88
Apr-89
Apr-90
Apr-91
Apr-92
Date
Yearly Cumulative Stream Flow Depleted by Pumping as Percentage

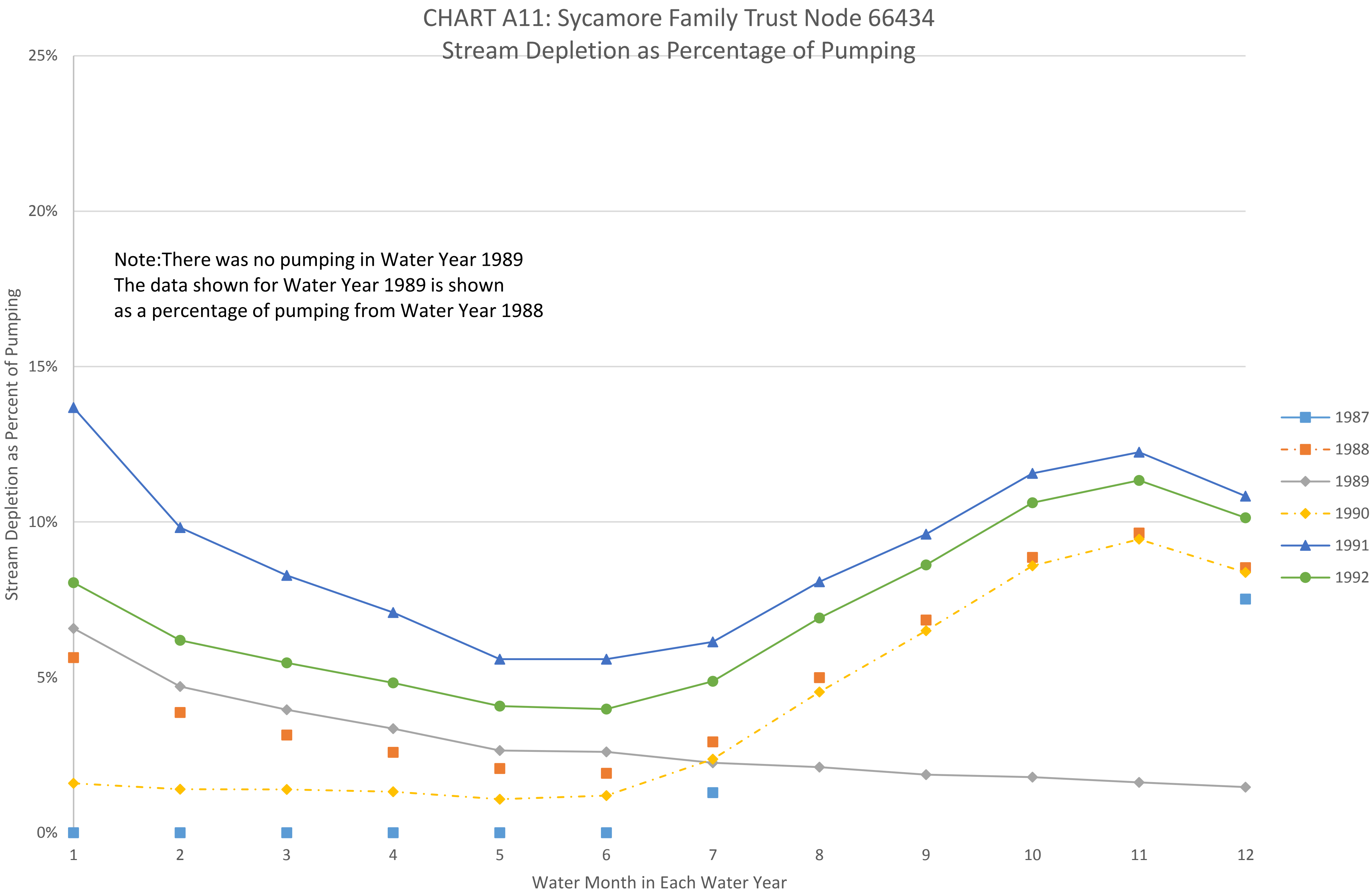


CHART A11: Sycamore Family Trust Node 66434
Stream Depletion as Percentage of Pumping
Note:There was no pumping in Water Year 1989
The data shown for Water Year 1989 is shown
as a percentage of pumping from Water Year 1988
Stream Depletion as Percent of Pumping
25%
20%
15%
10%
5%
0%
1
2
3
4
5
6
7
8
9
10
11
12
Water Month in Each Water Year
1987
1988
1989
1990
1991
1992

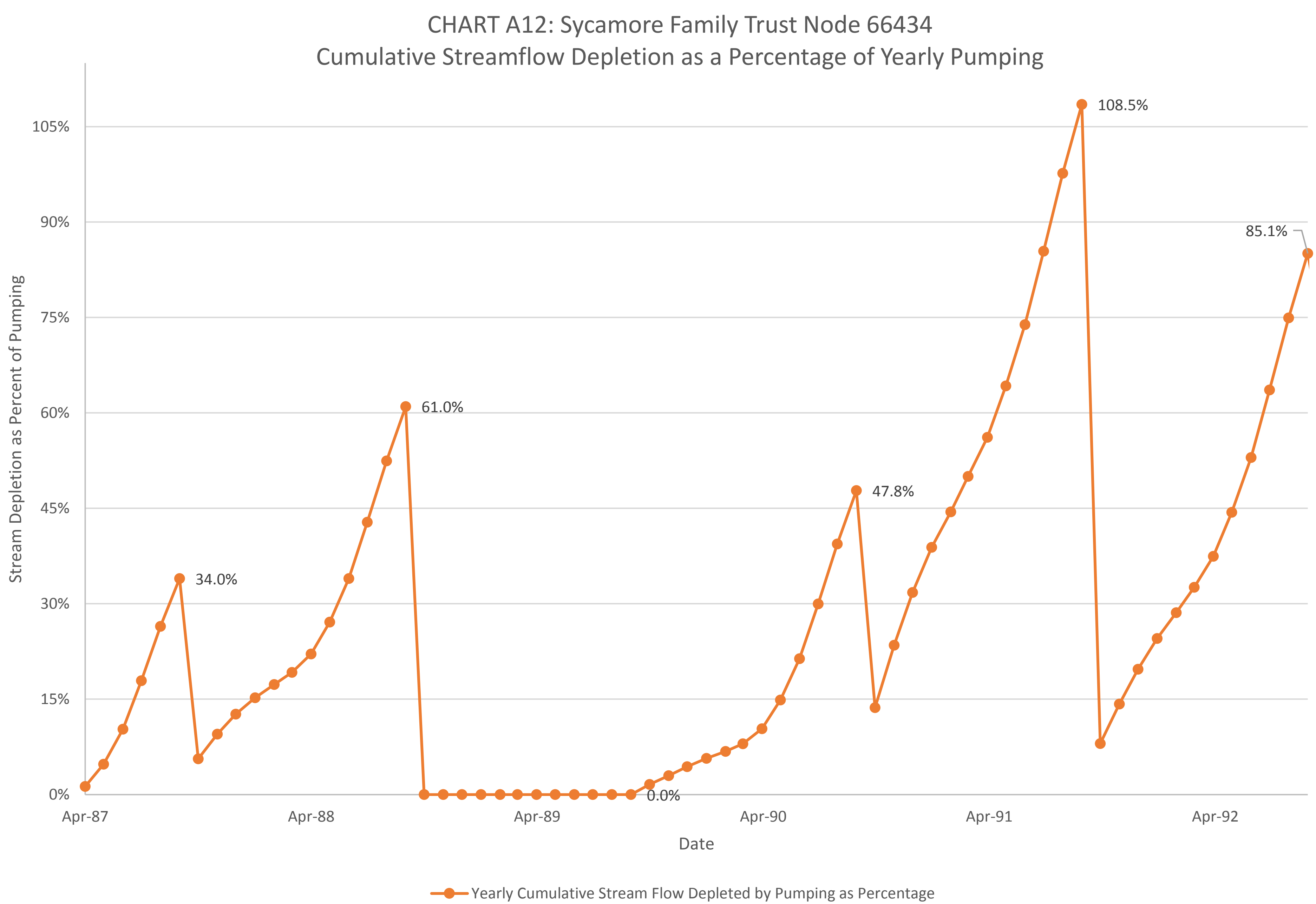


CHART A12: Sycamore Family Trust Node 66434
Cumulative Streamflow Depletion as a Percentage of Yearly Pumping
Stream Depletion as Percent of Pumping
105%
90%
75%
60%
45%
30%
15%
0%
34.0%
61.0%
0.0%
47.8%
108.5%
85.1%
Apr-87
Apr-88
Apr-89
Apr-90
Apr-91
Apr-92
Date
Yearly Cumulative Stream Flow Depleted by Pumping as Percentage

ATTACHMENT B

OVERVIEW OF IWFM SIMULATION CODE CAPABILITIES AND C2VSIM-CG MODEL CONDITIONS ASSESSMENT FOR STREAMFLOWS

Overview of IWFM

The Integrated Water Flow Model (IWFM) is a fully documented FORTRAN based computerized mathematical model that simulates ground water flow, stream flow, and surface water – ground water interactions. IWFM was developed by staff at the California Department of Water Resources (DWR). IWFM is GNU licensed software, and all the source codes, executables, documentation, and training material, are freely available on DWR's website.

The hydrological processes that are simulated in IWFM are the groundwater heads in a multi-layer aquifer system, stream flows, lakes (open water bodies), direct runoff of precipitation, return flow from irrigation water, infiltration, evapotranspiration, vertical moisture movement in the root zone and the unsaturated zone that lies between the root zone and the saturated groundwater system.

The interaction between the aquifer, streams and lakes as well as land subsidence, tile drainage, subsurface irrigation and the runoff from small watersheds adjacent to model domain are also modeled by IWFM.

IWFM is a water resources management and planning model that simulates groundwater, surface water, groundwater-surface water interaction, as well as other components of the hydrologic system. Preserving the non-linear aspects ofthe surface and subsurface flow processes and the interactions among them is an important aspect of the current version of IWFM.

Simulation of groundwater elevations in a multi-layer aquifer system and the flows among the aquifer layers lies in the core of IWFM. Galerkin finite element method is used to solve the conservation equation for the multi-layer aquifer system. Stream flows and lake storages are also modeled in IWFM. Their interaction with the aquifer system is simulated by solving the conservation equations for groundwater, streams and lakes simultaneously.

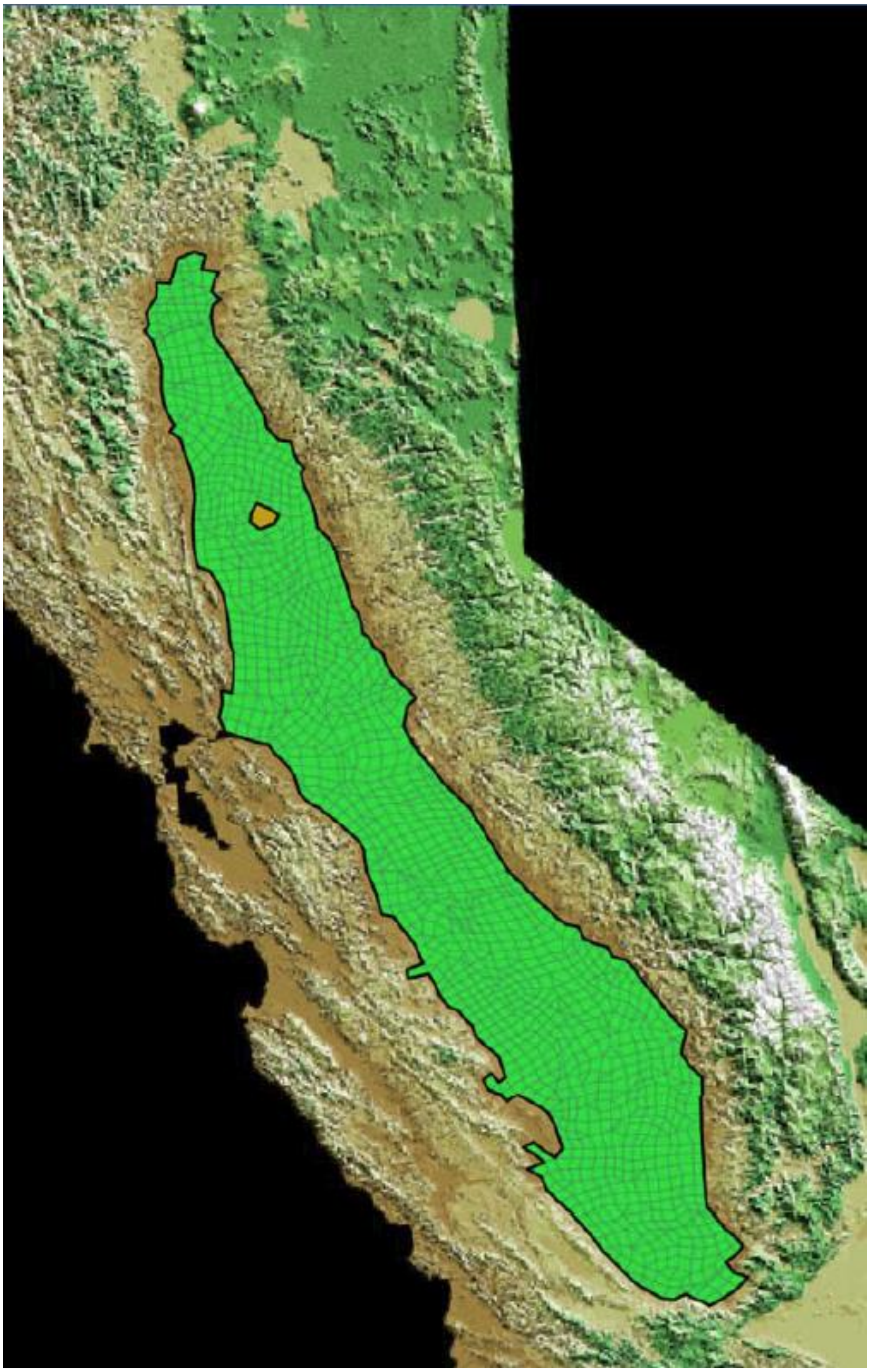
An important aspect of IWFM that differentiates it from the other models in its class is its capability to simulate the water demand as a function of different land use and crop types, and compare it to the historical or projected amount of water supply. The user can specify stream diversion and pumping locations for the source of water supply.

User-specified diversion and pumping amounts can be distributed over the modeled area for agricultural irrigation or urban municipal and industrial use. Based on the precipitation and irrigation rates, and the distribution of land use and crop types over the model domain, the infiltration, evapotranspiration and surface runoff can be computed. Vertical movement of the soil moisture through the root zone and the unsaturated zone that lies between the root zone and the saturated groundwater system can be simulated, and the recharge rates to the groundwater can be computed.

Overview of C2VSim- CG

C2VSIM-CG Boundaries and Grid

The model encompasses approximately 20,000 square miles. The finite-element grid has 1393 nodes, 1392 elements.



Model Layering

There are three explicit groundwater layers in C2VSim with two aquitards layers between the three layers. The bottom of layer 1 was specified to attempt to maintain a minimum saturated thickness of 100 ft except at the model lateral boundaries. The bottoms of layers 1 and 2 were set to incorporate the depth of most groundwater extraction well screens into one or both layers. The bottom of layer 3 was set at the base of fresh water

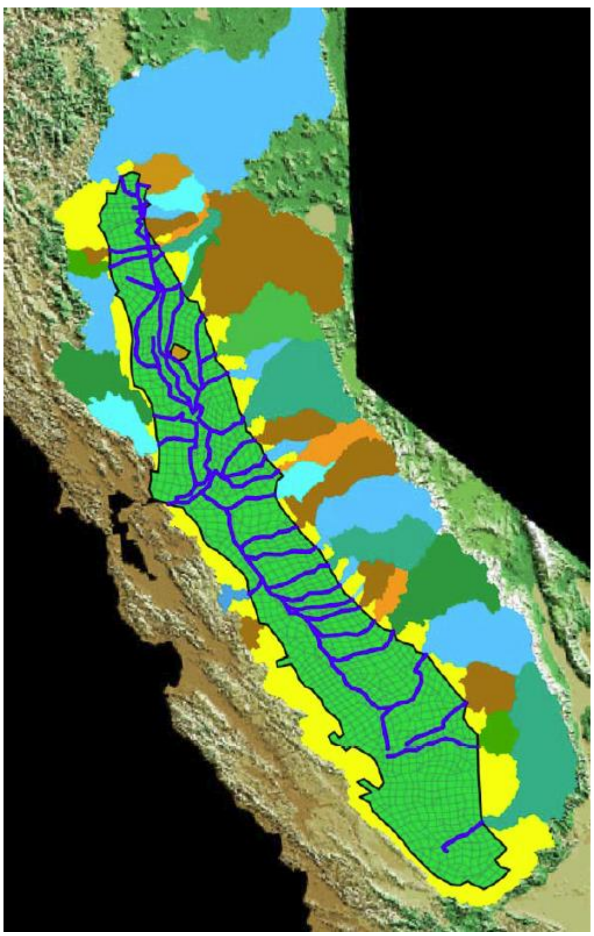
C2VSIM Land Use Process

For the land use process module C2VSIM defines 21 subregions that correspond to the Joint DWR-USBR Depletion Study Drainage Areas (DSAs)

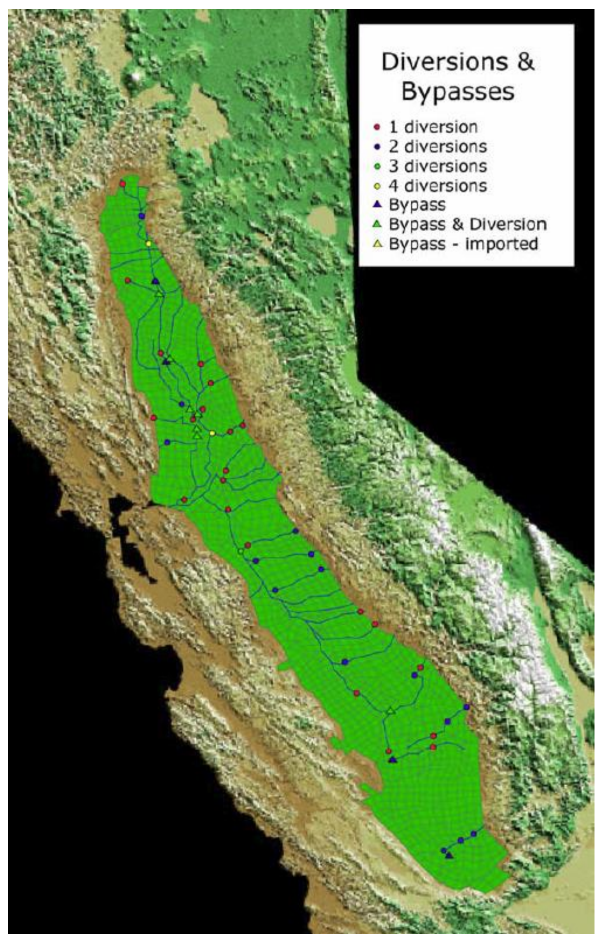
The land use type modules that are simulated in the model are:

- Agriculture
- Urban
- Native
- Riparian

Watersheds and Streams



Major watersheds have gaged flows to C2VSIM streams. Minor watersheds are treated using IWFM Small Watersheds process module.



The model incorporates 72 stream reaches and 97 surface water diversion points. There are two lakes within the model domain. There are also eight flood water bypass canals modeled as surface water diversions in the domain but with their own hydraulic characteristics to differentiate them from other diversion points.

Model Input Parameters

Precipitation Stations and Zones

The model inputs were derived from 32 precipitation stations. Monthly precipitation data from October 1921 to September 2009 were input to the model. Elemental multipliers were used to match the monthly precipitation arrays from the Precipitation Regression Inverse Slope Model (PRISM) 1971-2000 from Oregon State University

Hydraulic Parameters

Horizontal hydraulic conductivity

- 20 – 80 ft/day in layers 1 and 2
- 5 ft/day in layer 3

Vertical hydraulic conductivity

- $5x10^{-5}$ – $1x10^{-3}$ ft/day

Specific yield

- 0.12 – 0.18

Specific storage

- $2x10^{-5}$ ft^{-1}

C2VSIM calibration

C2VSIM calibration was done in an organized sequence of steps. The first step was to update the Conceptual Model for:

- Small watershed delineation
- Precipitation data and stations
- Model Layering and Thicknesses
- Initial heads
- Stream-bed elevations
- Rainfall Runoff Uniform Curve Numbers
- Agricultural root-zone process

The calibration data used included:

- 1976 water level maps for layers 1 & 2
- Head observations at 221wells
- Single screen coincides with model layering
- Measurements before 1977 and after 1997
- No more than one well per model element
- Vertical head gradients at 9 locations
- Average stream accretions and depletions

Calibration was done using PEST with Pilot Points to do inverse parameter fitting to achieve best estimates of parameters to fit through observations (i.e. field data). The calibration sequence used was:

1. Land use process

- Agricultural root-zone process
- Curve numbers

2. Groundwater flow system

- Hydraulic conductivity of layers 1 & 2
- Vertical anisotropy
- Specific yield in layer 1

3. Surface water flow system

- Stream-bed conductivity

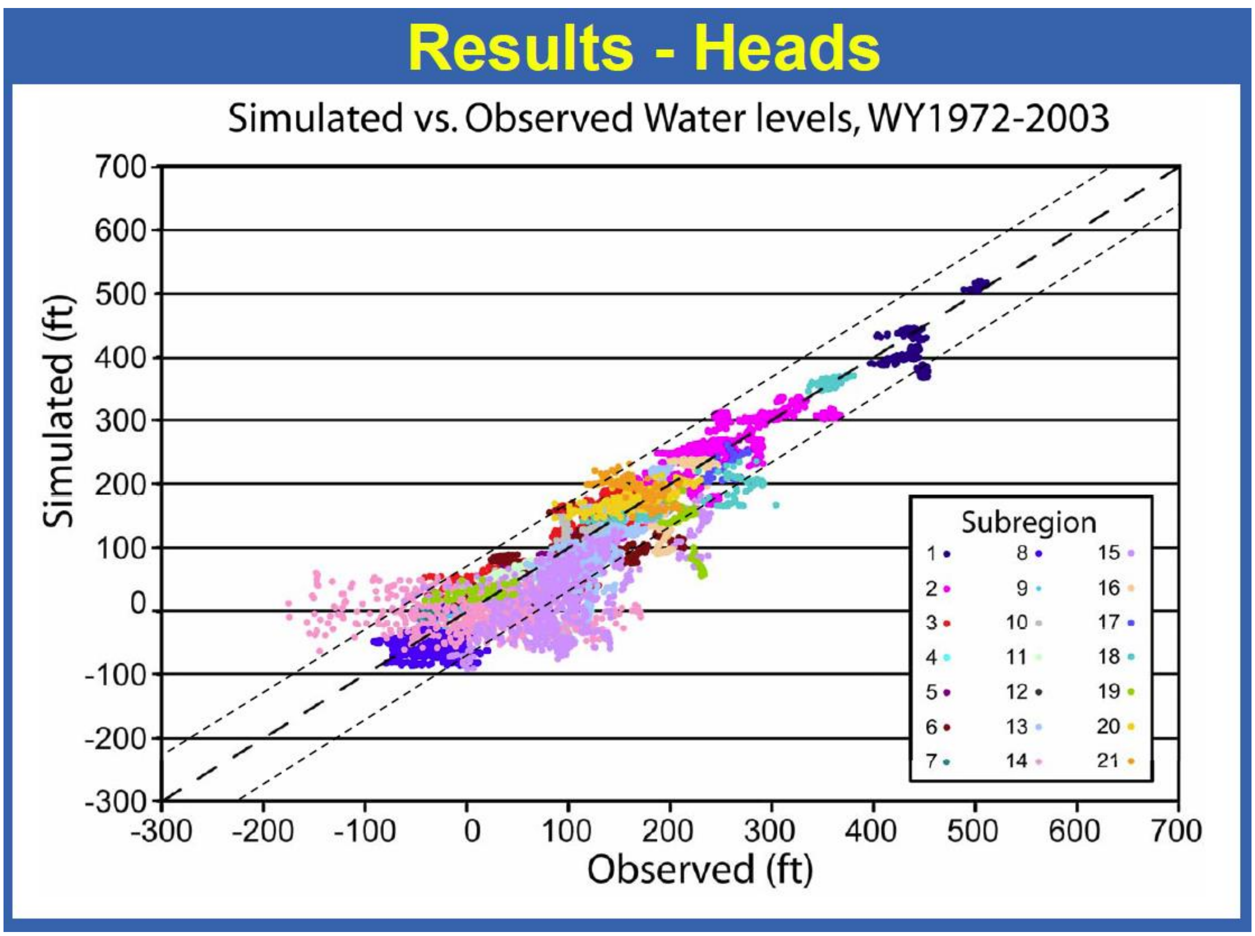
Calibration Results

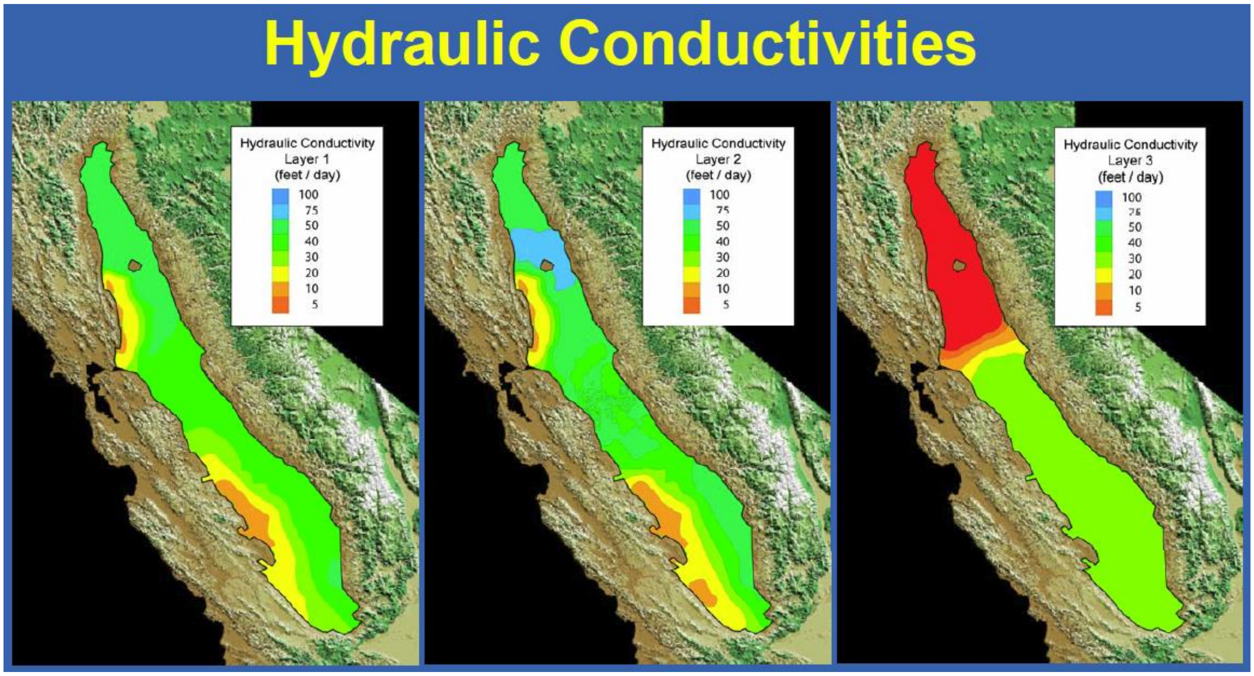
Water Levels:

- Layer 1 generally good
- Layer 2 high beneath Corcoran Clay

Spatial correlation of head residuals

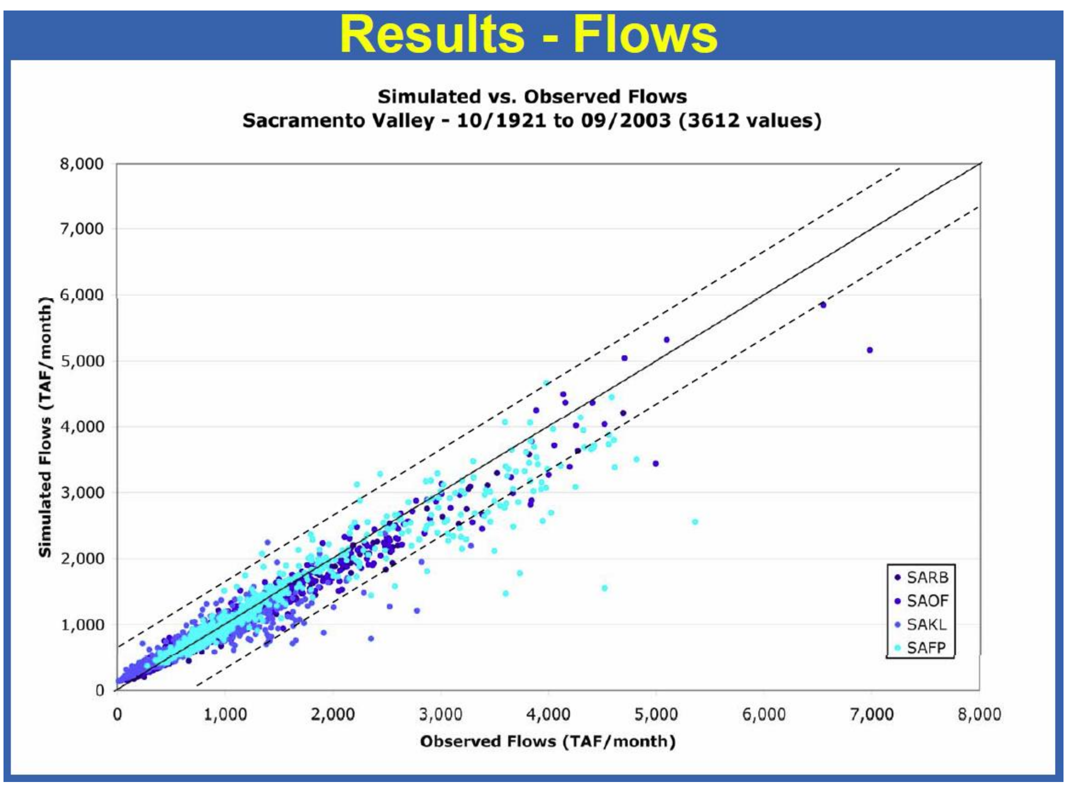
- Reasonable in Sacramento Valley (low on western edge)
- Low in western San Joaquin Valley
- High beneath Corcoran Clay
- Simulated water level trends match observed water level trends on a regional basis



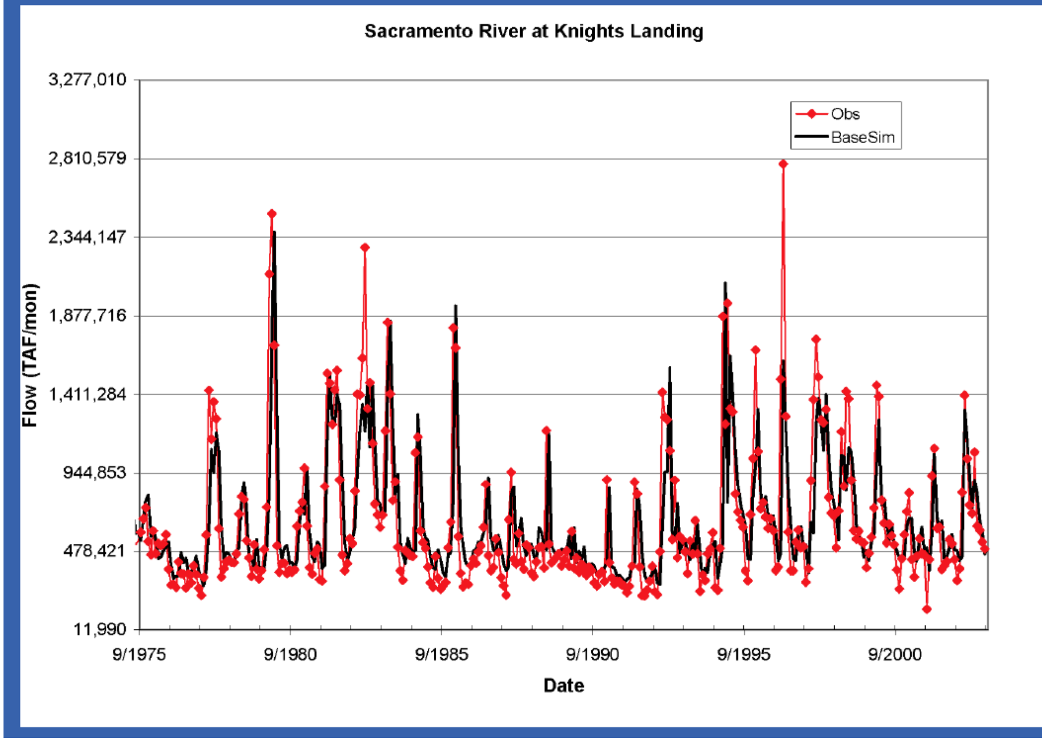


Water Budget Items

C2VSIM shows net groundwater discharge to streams. C2VSIM simulated stream accretions and depletions have same sign as observed, and magnitude is close



Results - Flows



E PUR
Safe Water for All

ATTACHMENT C

REVIEW OF SACFEM 2013 CONSTRUCTION AND CALIBRATION

SACFEM2013 Model Notations

SACFEM2013 is built using the MicroFEM simulation code. MicroFEM as a groundwater simulation code cannot accurately calculate some of the key physical processes in the water budget such as evapotranspiration within a shallow groundwater aquifer. It is unable to simulate the physical processes and fully account the changes in surface water flow and groundwater to surface water exchange. A proper basis for the selection of a proprietary model code, that has not been independently verified as to its numerical solution's accuracy, and that does not contain necessary algorithms and proper mathematical formulations to the questions at hand, is not provided in Appendix D. 72

The EIS/EIR in Appendix B states:

> *"SACFEM2013 is a full water budget based, transient groundwater flow model that incorporates all groundwater and surface water budget components on a monthly time-step over the period of simulation. SACFEM2013 provides very high resolution estimates of groundwater levels and stream flow effects due to groundwater pumping within the Sacramento Valley."*

This statement is not accurate and is notably not repeated in the text of Appendix D.

Review of Appendix D on SACFEM2013 Documentation

The documentation of SACFEM2013 is grossly inadequate. The documentation of SACFEM2013 is less than that found for SACFEM in 2011. There is no calibration data provided. No discussion of model residuals or fit to any type of observed data. There is no quantification of model uncertainty or limitations provided in Appendix D. In our review we have been unable to comprehend the model from its documentation. Instead it has required exploring primary data inputs through the GIS database from which it was constructed. 73

SACFEM2013 is built in Version 4.10 of MicroFEM. No documentation for this version of the code is cited or provided.

Vertical Structure goes to base of the freshwater aquifer and treats that boundary as a no-flow boundary.

Boundary Conditions

Head Dependent Boundaries

Surface Water fluxes

- 50 individual streams are simulated using the "wadi" package in the current version of SACFEM2013
- User specified stream stage 74
  - Transient monthly "varying distributions" of stream-stage height were developed for each reach with no documentation of how this was calculated)
  - User specified stream stage imposes error on model outcomes
- Model calculated head is driver on gradient vs. user specified stage.
- Streambed Conductance (from subformula)
  - D_r = streambed thickness = uniformly assumed to be 1 meter

- K_v = streambed conductivity (
    - Assumed to be 2 meters/day on the eastside, and
    - 5 meters/day on the westside, two exceptions on Eastside for Bear River and Big Chico Creek)
    - **Review and use of model input data K_v as found in the GIS files to the Delta Water Agencies found K_v values in the eastside ranging from 1 meter/day to 0.1 meter/day in the locations selected.** 74
- L = stream length represented by the model node
- A = nodal area
- W = "field width" of the reach represented by L
    - Wetted Stream width taken from aerial photographs at two locations

Appendix D comments that stream length is generally overestimated at river confluences. Manual adjustments were noted without description of how these were calculated.

Streambed elevations were developed from a DEM; there is an odd note of the DEM resolution being lower than stream node resolution when stream node resolution is reported to be on the order of 250 meters and conventional DEM resolution is on the order of 10 to 30 meters with a precision of plus/minus approximately 8 feet.

Drains

SACFEM2013 used the Drain package to simulate the upper land-surface groundwater boundary condition across the domain. Efflux nodes only that are head dependent. Elevation of drain set at land surface. Why were drains not set to the root zone depth to represent ET from the groundwater domain? Formulas provided for the drain stage are underdocumented 75

Specified Flux Boundaries

These denote boundaries where a influx or outflux of water occurs at a set rate per period that is user specified and not model calculated. Specified flux boundaries were set for:

- Deep Percolation
- Mountain Front Recharge
- Urban Pumping

Deep percolation of water

This was reportedly done by surface water budget approach 76

- Water budget estimated using spatial information
    - Land use
    - Cropping patterns
    - Source of Agricultural Water
    - Surface water availability in different year types and locations
    - Spatial distribution of precipitation
- Components
    - Deep percolation of applied water
    - Deep percolation of precipitation
    - Agricultural pumping
- Developed by intersecting

    - GIS data developed by DWR (no citation) – Transient Condition on Land Use
    - With SACFEM model grid
- Results in a land use for each groundwater model node
- GIS data on water district and non-district areas derived
- Water source information to the areas(where does this come from? – no citation or methodology described) 76

Methodology for Surface Water Budget

The methodology is underdocumented. Semi physically based soil moisture accounting model used; it is not clear if this is IDC

Historic precipitation data

Simulates root zone processes and calculates applied water demand and deep percolation past the root zone for each node.

Deep percolation was split between applied water and precipitation. Split was dependent on the season and availability of water from each source

Their calculated values for deep percolation were reportedly compared to DWR Estimated Values for the Year 2000 (no citation). They corresponded with DWR Northern District staff (no citation of who) They adjusted soil parameters in root zone model to reportedly match volumes of percolation to DWR (no citation of DWR data source nor provision of data). 77

Agricultural Pumping calculated from demand for applied water (**no mention found of crop typing or climatic drivers on water demand for applied water**) compared to source water availability from surface sources via GIS intersection of districts

- Split out of groundwater and surface water for certain areas
- Or all groundwater
- Mention of a "level of development simulation of CVP operations" was used to calculate availability of surface water
- Agricultural pumping applied to Layers 2, 3, and 4 only. There is no clear basis for this placement of pumping.

Mountain Front Recharge

Utilized an annual formula from Turner 1991 for a Mediterranean climate and converted the total deep percolation estimated per upper watershed into monthly quantities by looking at streamflows in "ungauged" sections of Deer Creek. Water inserted into Layer 1 at the model boundary. 78

Urban Pumping

Used groundwater use data form Urban Water Management Plans, for population centers above 5,000 people that rely on groundwater. For areas that did not have UWMPs used 271 gpd per person times census to get to groundwater use. Areas of North Sacramento County pumping/usage were stated as consistent with the local SacIGSM model (Note that SacIGSM is built in a predecessor code to IWFM) 79

No Flux Boundaries

Bottom of Layer 7, the freshwater interface. 80

Aquifer Properties

To develop hydraulic conductivity they reportedly used 1,000 wells within model domain with construction information and specific capacity data on Well Completion Reports. Shallow wells (<100 feet) and those with production below 100 gpm were eliminated for aquifer properties (except at the margins of the model domain where aquifers were presumed to be thin). Specific capacity data were 81 converted to calculated transmissivity (T) using an empirical method that is not accurate. A specific capacity can be strongly influenced by turbulent head losses at the well if the pumping rate of the well is high relative to the length of well screen and the well screen open area. The calculated T value was reportedly divided by screen length to derive initial K_h.

They state there is not enough data to define depth dependent K_h. Cooper-Jacob confined aquifer method was assumed in their analysis of aquifer transmissivity.

Peer Review Comments

Deep Percolation

- IDC calculated deep percolation rates are excessive
    - Deep percolation reduction factors were created for IDC outputs before use in SacFEM
- SacFEM deep percolation rates are not supported by the fundamental IDC model methodology 82 and parameters resulting in a disconnect between SacFEM and IDC.
    - Recommended incorporating a feedback loop between the 2 models and subjecting them to convergence criteria
    - SacFEM deep percolation rates are not consistent with other data sets and it should be ensured that they are supported by historical land use, crop mix, and agricultural practices

Stream Aquifer interaction

- The flow exchanged between streams and aquifers is a function of head difference between groundwater elevation and stream stage with impedance by streambed resistance.
- The assumption of constant stream stage results in stream-aquifer relationship dependent on streambed resistance and groundwater elevation
- Assumption of constant stage is not valid 83
- Recommended that SacFEM use time varied stream stage data

The 2011 peer review contained a primary statement of revisions to SACFEM from 2009 that:

> *"Documentation on SacFEM and the IDC Model – Model documentation, with appropriate level of detail on data collection, analysis, and input data preparation should be developed."*

Model Calibration Information

The following model calibration figures were obtained from the 2009 and 2011 SACFEM model documentation.

DOCUMENTATION OF THE SACFEM GROUNDWATER FLOW MODEL

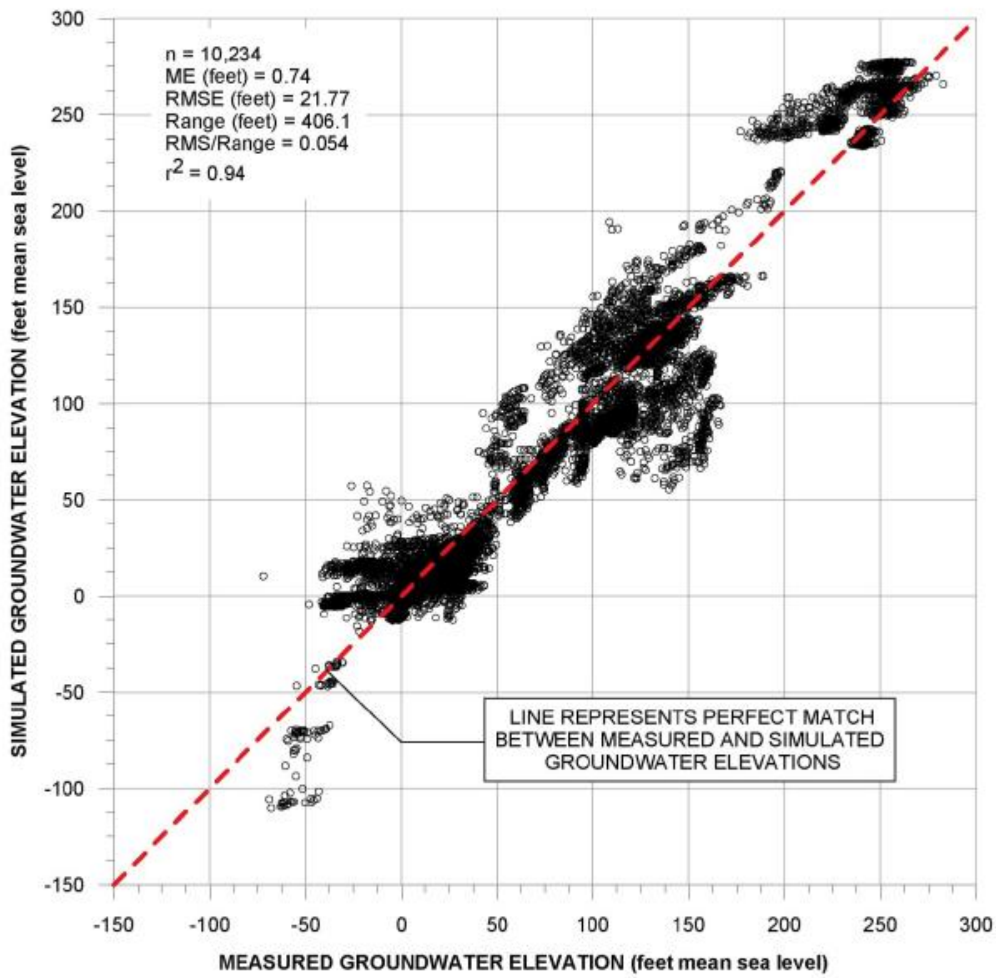


FIGURE B-9
Transient Calibration Scattergram

This model calibration demonstrates that in several areas model estimates exceed actual measured data by more than 65 feet, the thickness of Layer 1 in SACFEM2103. This is notable in the region around 150 feet MSL on the attached chart, B-9, found in the 2011 model documentation. Additional calibration figures by well are found on the pages that follow and demonstrate a lack of fit to trend or data at many wells.

84

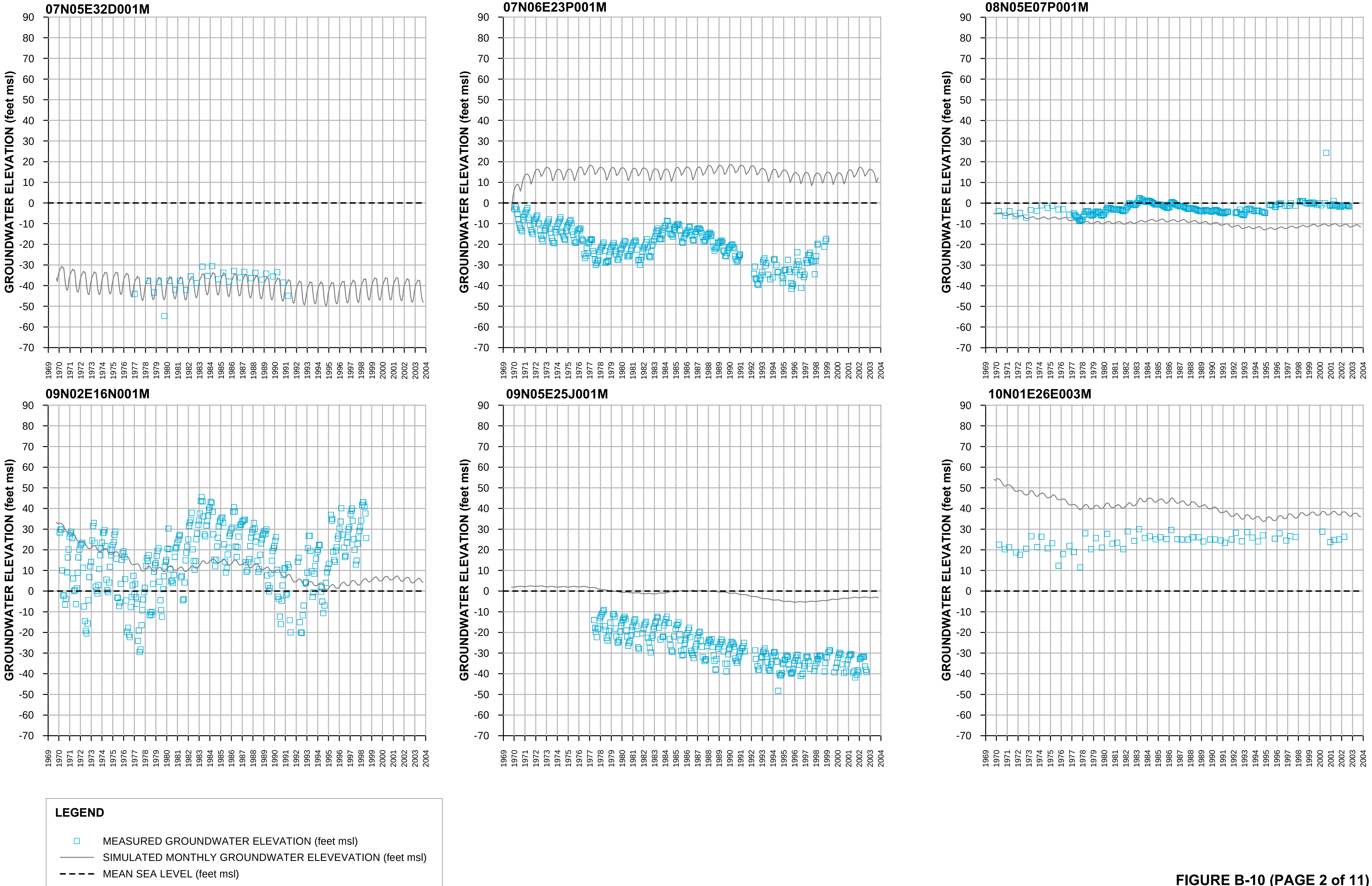
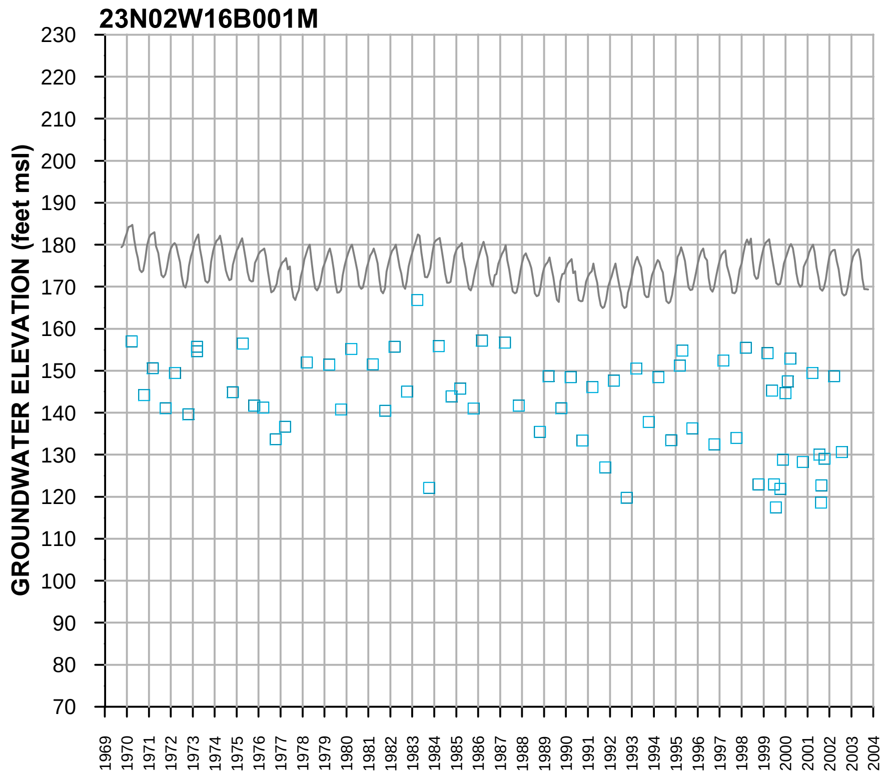


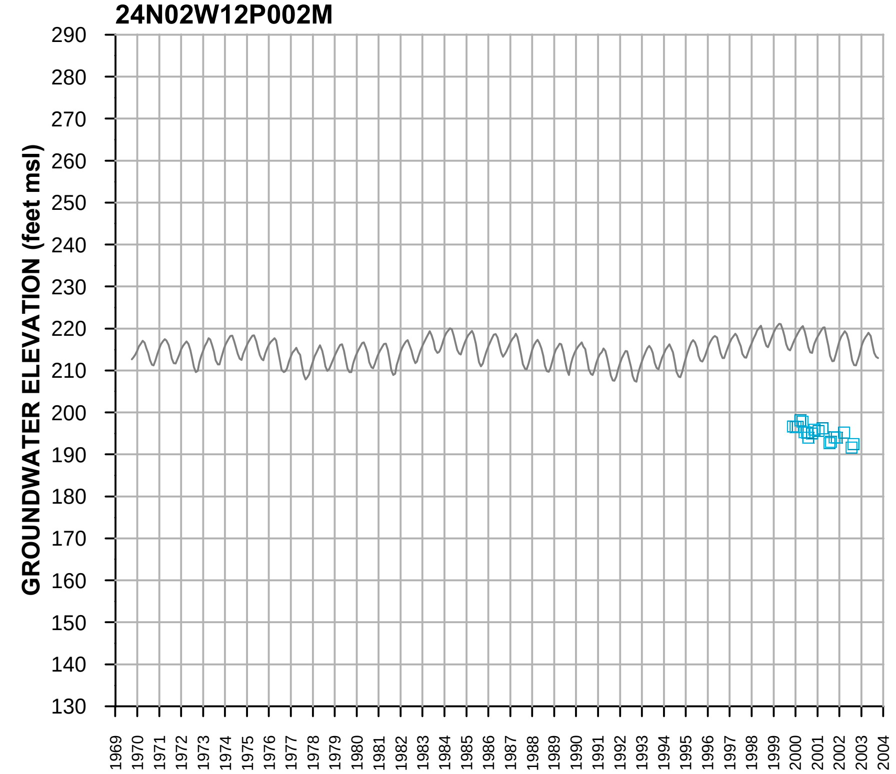
FIGURE B-10 (PAGE 2 of 11)
TRANSIENT CALIBRATION HYDROGRAPHS
DOCUMENTATION OF THE SACFEM
GROUNDWATER FLOW MODEL
SACRAMENTO VALLEY GROUNDWATER BASIN

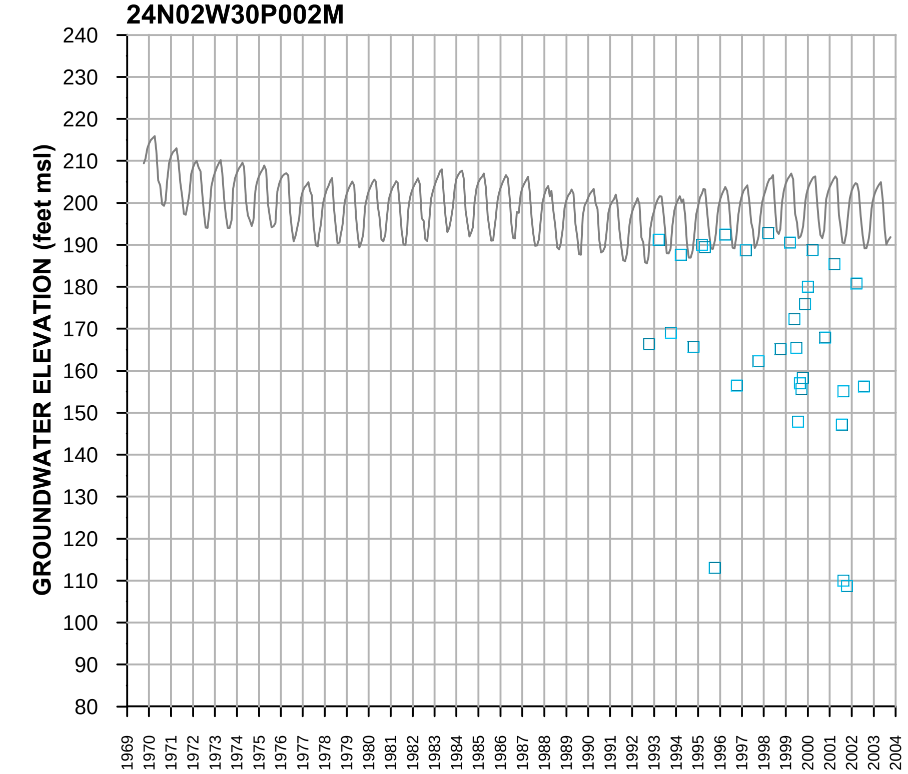
FIGURE B-10 (PAGE 8 of 11)
TRANSIENT CALIBRATION HYDROGRAPHS
DOCUMENTATION OF THE SACFEM
GROUNDWATER FLOW MODEL
SACRAMENTO VALLEY GROUNDWATER BASIN

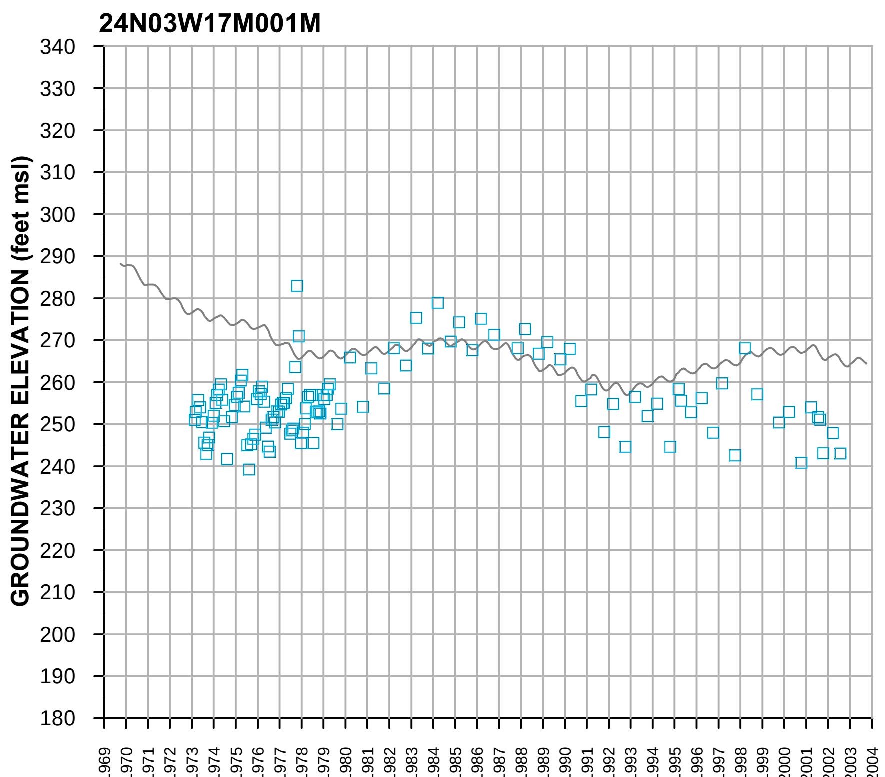
CH2MHILL

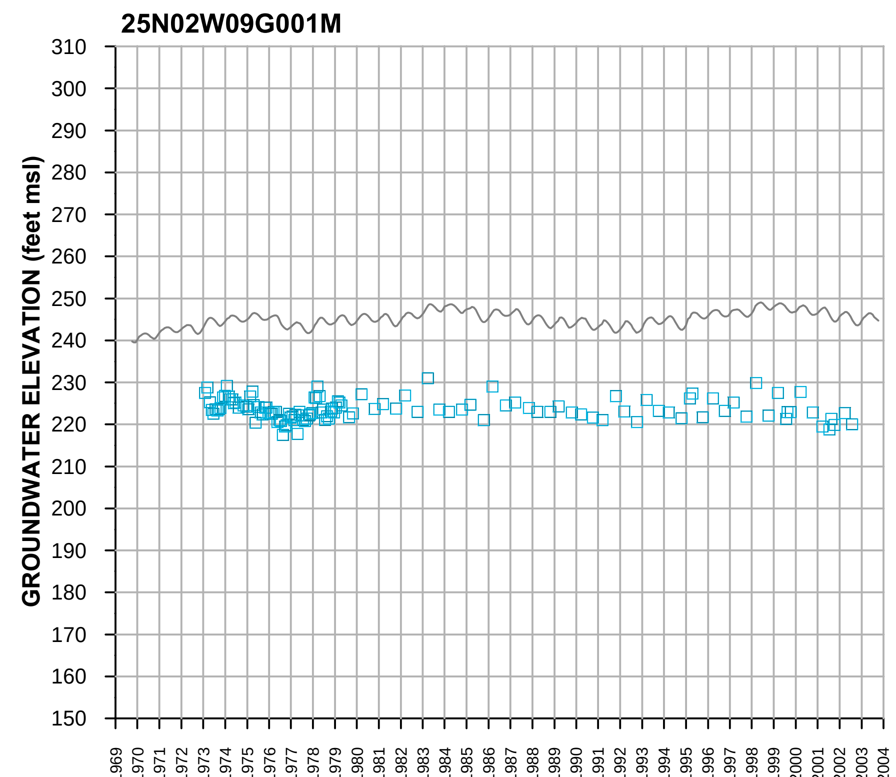
HYDROGRAPHS8.grf

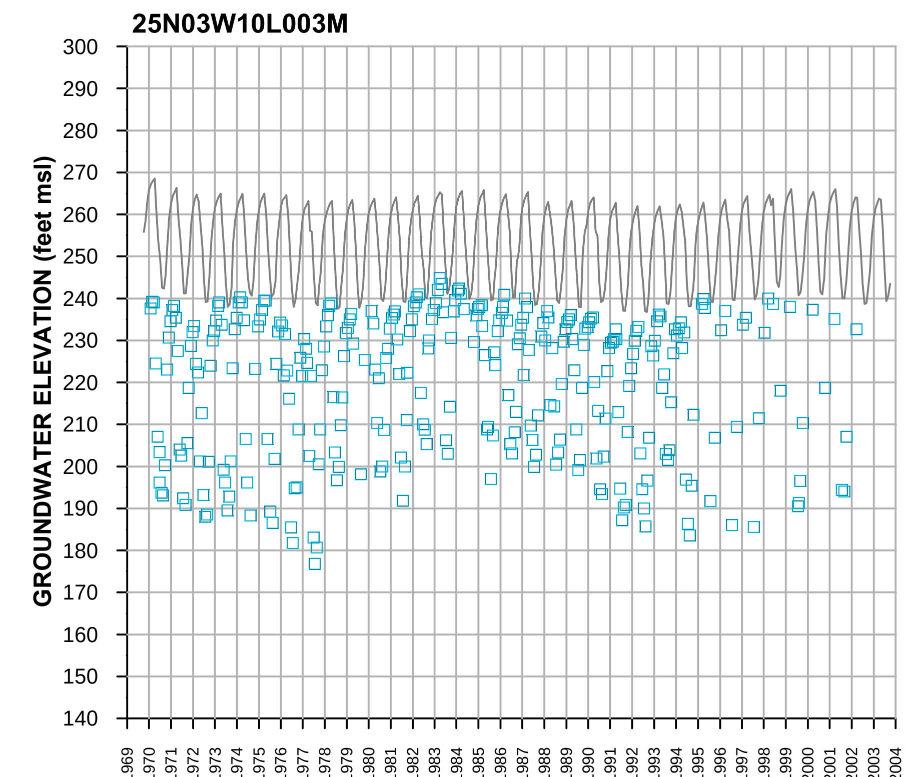












LEGEND

- MEASURED GROUNDWATER ELEVATION (feet msl)
- SIMULATED DAILY GROUNDWATER ELEVEVATION (feet msl)
- MEAN SEA LEVEL (feet msl)

FIGURE B-10 (PAGE 10 of 11)
TRANSIENT CALIBRATION HYDROGRAPHS
DOCUMENTATION OF THE SACFEM
GROUNDWATER FLOW MODEL
SACRAMENTO VALLEY GROUNDWATER BASIN

CH2MHILL

HYDROGRAPHS10.grf

ATTACHMENT D

Delta Water Quality Violations 2013

BUREAU OF RECLAMATION
Central Valley Operation Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

DEPARTMENT OF WATER RESOURCES
Division of Operations and Maintenance
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

MAY 24 2013

IN REPLY REFER TO:
CVO-100
WTR-4.10

Thomas Howard
Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, California 95814

Subject: April 2013 Exceedence of Salinity Objectives at Emmaton

Dear Mr. Howard:

On April 28, 2013, the Bureau of Reclamation and the Department of Water Resources (collectively the Projects) exceeded the D-1641 salinity objective at Emmaton. Project operations staff notified State Water Resource Control Board (SWRCB) staff of the exceedence by conference call on April 29, 2013, and by e-mail notification to the SWRCB. This letter provides formal notification of the exceedence and background information relevant to the circumstances.

Background information leading to exceedence conditions:
The exceedence of the 14-day running average of 0.45 EC salinity objective at Emmaton for a Sacramento Valley Dry Year type was caused by the interaction of two conditions: low river flows on the lower Sacramento River system culminating at Freeport, and increasing tides during the period of April 21, 2013, through April 25, 2013. Tidal trends and fluctuations are conditions generally anticipated by Project operators as part of salinity objective compliance; however, the low flow conditions on the lower Sacramento River system in late April 2013 was not anticipated by Project operators and is the main factor of the exceedences that have occurred at Emmaton.

Precipitation patterns for water year 2013 have been a scenario of extremes. The months of November and December produced significant rainfall and project reservoir storage correspondingly increased without any significant flood control releases from major project reservoirs. The calendar year precipitation, however, has been dismal. The accumulation of rainfall since January 1 for the long record of the Northern Sierra 8-Station Precipitation Index is approximately 8.8 inches. Currently, this value represents the driest calendar year period in the long precipitation record--even drier than the very dry single years of 1977 and 1924. Creek and small stream flows that enter the Sacramento River system below major reservoirs are running at historically very low levels in response to this long, dry precipitation period. (Attach 8SI plot)

Historically, the initial diversion for rice cultivation and ponding has generally occurred from late April to early May, depending on farmer cultivation and preparation practices and soil moisture conditions, to allow farmers to prepare their fields. Generally, project operators have observed this diversion to rice fields occur over several weeks from late April to early May, and have monitored river conditions and increased reservoir releases as rice cultivation diversion rates increased. It now appears that in 2013, due to the very dry hydrologic conditions since the first of the year, a very large portion of rice fields were cultivated and ready to begin their initial field flooding on a simultaneous schedule during the third week of April. This diversion to rice cultivation, although expected to occur, was unanticipated by Project operators for the sheer size and magnitude of simultaneous initial diversion for rice cultivation that actually occurred valley-wide.

Project operators responded to the increasing diversion rates during this period; by increasing reservoir releases in an attempt to catch up to the lower Sacramento River flow conditions. Figures 1 and 2 illustrate the Projects' reservoir release response to flow conditions in the lower Sacramento River during this period of unprecedented diversions. The first illustration shows Keswick's releases in response to the flow pattern at the Wilkins Slough river gage location. This section of the Sacramento River Basin is controlled exclusively with Shasta/Keswick reservoir releases with an approximate lagged travel time of 2.5 days between Keswick and Wilkins Slough. The second illustration indicates the reservoir releases in response to the flow pattern at the Verona river gage location. Verona flow is influenced by reservoir releases from Keswick Reservoir as well as Oroville Reservoir's releases to the Feather River. The approximate lagged travel time from Keswick is 3.5 days and just over one day from Oroville. Both illustrations show the dramatic increases from project reservoirs in response to low flow conditions observed along the lower Sacramento River. The dramatic increase in overall depletion rates experienced over a period of about ten days was simply not anticipated by project operators and is extreme from a historical perspective. Reservoir release rates of 11,000 cfs from Keswick Reservoir and 5,250 from Oroville Reservoir are more typical of late May than late April even in a dry condition. Folsom Reservoir releases were increased from 1,000 cfs to 1,250 cfs on April 25, 2013, to also contribute to lower Sacramento River flows.

The result of this unusual condition and timing is that Freeport flows entering the Delta were very low for a period of a week to ten days. (See Operational Report). At the same time, pulse flows were entering the Delta from the San Joaquin River at Vernalis as part of the annual pulse flow management from the San Joaquin River Basin. Due to the low flow conditions at Freeport, salinity conditions in the vicinity of Collinsville and Emmaton along the extreme lower Sacramento River and western Delta increased dramatically as tidal conditions increased. (See Operational Report). Project operators responded to the changing conditions by reducing scheduled exports that were anticipated to be near a 1:1 ratio with Vernalis flow in order to maintain Delta outflow conditions necessary to meet X2 objectives at Collinsville. Without adequate flows at Freeport to repel salinity conditions in the lower Sacramento River, salinity levels near Emmaton inevitably exceeded the dry year objective of the maximum 14-day running average of mean at 0.45 salinity. Project reservoir releases stabilized Freeport flows at greater than 10,000 cfs beginning April 28, 2013, and averaged above this rate until compliance of the 14-day 0.45 EC objective at Emmaton was re-established on May 19.

Challenges facing project operations for the remainder of year:
By D-1641 criteria, water year 2013 is classified as a "Dry" year as published in the last Bulletin 120 update for May 1st hydrologic conditions. As previously mentioned, water year 2013 has been a year of extremes with generally wet conditions in November and December and retention of storage in upstream reservoirs, followed by extreme and possibly record dry precipitation conditions since January 1. This pattern of hydrologic conditions will very likely bring challenges for the remainder of this water year. Reservoir storage in Shasta and Oroville is in reasonably good shape, but will be relied upon heavily under adverse hydrologic conditions to balance the goals of Sacramento Valley diversion/depletion, Delta objectives, water supply delivery, and coldwater management. Folsom Reservoir management will be challenged by the overall availability of water and limited coldwater availability. The hydrologic conditions of 2013 and the early advent of significant depletion rates in the Sacramento Valley may indicate that historic high levels of Sacramento Valley depletions are likely during this year's irrigation season. (Projecting seasonal Sacramento Valley depletions, as compared to projecting full natural river flows in Bulletin 120, could be a difficult extrapolation from historic values, and uncertainty in depletion values is always a challenge to project operations.)

If you have any questions or would like more information regarding this notification, please contact Mr. Paul Fujitani of Reclamation at 916-979-2197 or Mr. John Leahigh at 916-574-2722.

Sincerely,

Ronald Milligan — for D. Roose

Ronald Milligan, Operations Manager
Central Valley Operations Office
U.S. Bureau of Reclamation

David H. Roose, Chief
SWP Operations Control Office
Department of Water Resources

Attachment -2

cc: See next page.

cc: Mr. John Herrick, Esq.
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Carolee Krieger
808 Romero Canyon Road
Santa Barbara, California 93108

FIGURE 1

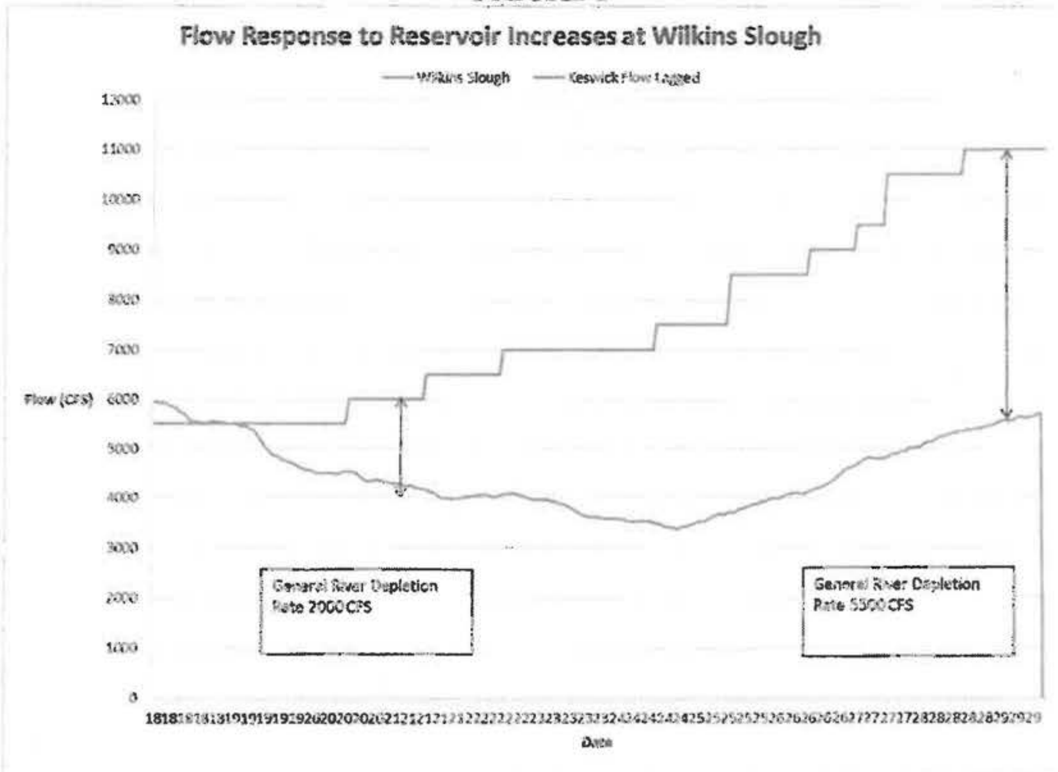
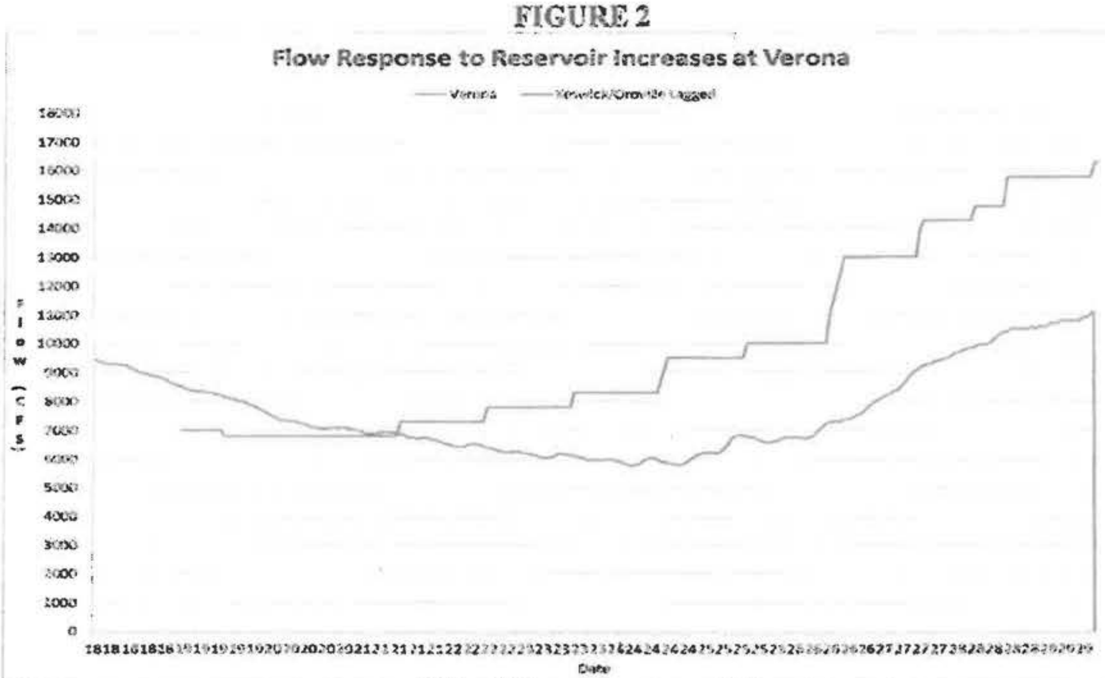
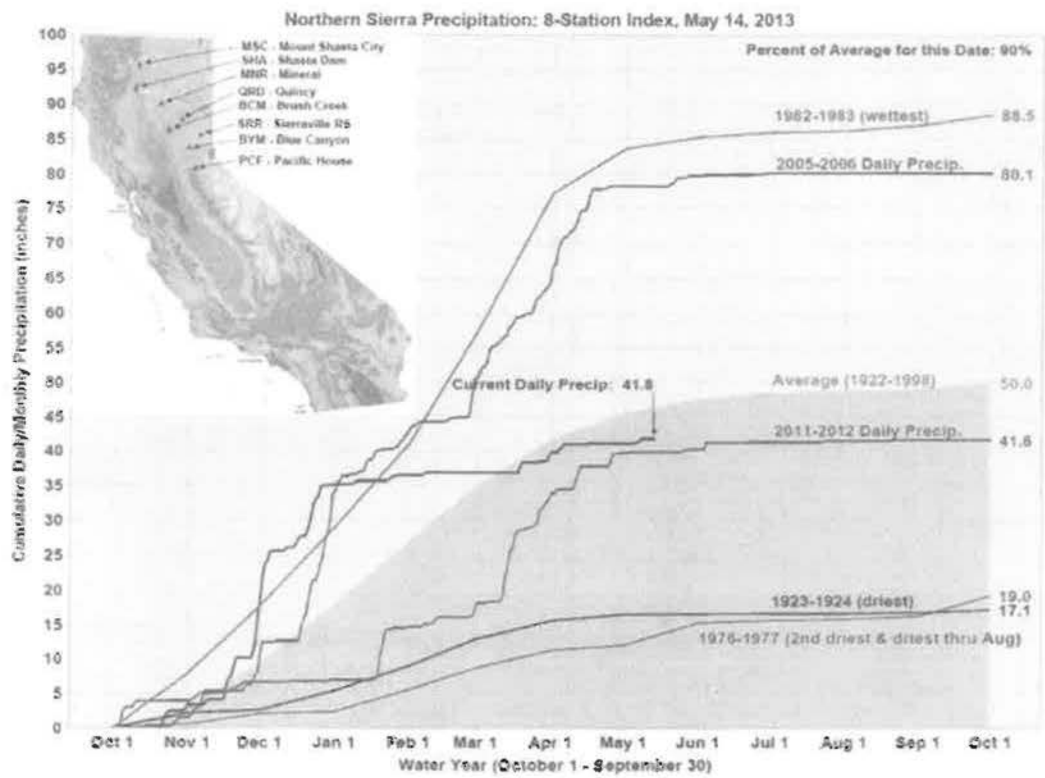


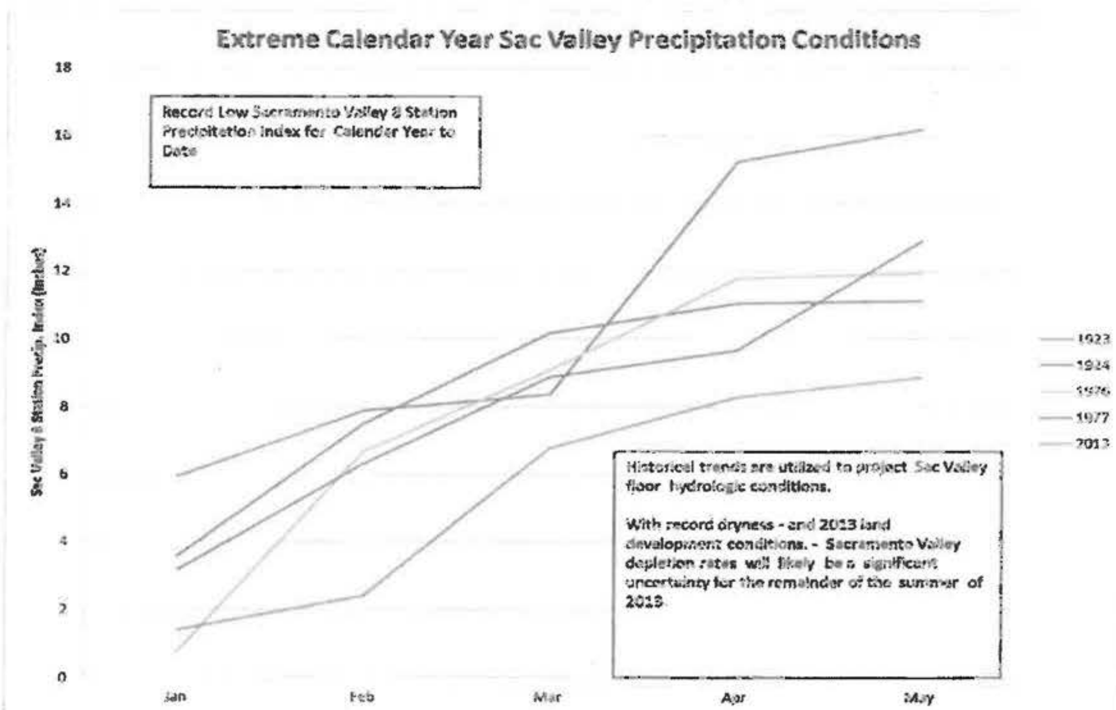
FIGURE 2



8SRI PLOT



Northern Sierra Precipitation: 8-Station Index, May 14, 2013
Percent of Average for this Date: 90%
1982-1983 (wettest)
88.5
2005-2006 Daily Precip.
80.1
Current Daily Precip: 41.8
Average (1922-1998)
50.0
2011-2012 Daily Precip.
41.6
1923-1924 (driest)
19.0
17.1
1976-1977 (2nd driest & driest thru Aug)
Cumulative Daily/Monthly Precipitation (inches)
Total Water Year Precipitation
Water Year (October 1 - September 30)



Extreme Calendar Year Sac Valley Precipitation Conditions
Record Low Sacramento Valley 8 Station Precipitation Index for Calender Year to Date
Historical trends are utilized to project Sac Valley floor hydrologic conditions.
With record dryness - and 2013 land development conditions. - Sacramento Valley depletion rates will likely be a significant uncertainty for the remainder of the summer of 2013.
Sac Valley 8 Station Precip. Index (inches)
1923
1924
1976
1977
2013

State of California - Department of Water Resources - Division of Operations & Maintenance - Operations Control Office

Compliance Standards

for the Sacramento - San Joaquin Delta and Suisun Marsh
Sunday, May 19, 2013

Criteria	Standard	Status
Flow/Operational		
% of inflow diverted	35 %	11 %
Habitat Protection, X2 / Flow	1 days at Chipps Island	3 days
* 2days as carryover from April	31 days at Collinsville	19 days
Water Quality		
Days @ CCWD PP#1 w/ chlorides <= 150 mg/l	155 days	139 days
Export Areas for SWP, CVP, CCWD, et al	<= 250 mg/l Cl	42 mg/l
14dm EC at Emmaton	<= 0.45 mS/cm	0.44 mS/cm
14dm EC at Jersey Point	<= 0.45 mS/cm	0.34 mS/cm
Maximum 30 day running average of mean daily EC at:		
Vernalis	<=0.7 mS/cm	0.3 mS/cm
Brandt Bridge	<= 0.7 mS/cm	0.3 mS/cm
Old River Near Tracy	<=0.7 mS/cm	0.4 mS/cm
Old River Near Middle River	<=0.7 mS/cm	mS/cm

SUISUN MARSH:

Suisun Marsh Salinity Control Gates : 1 Open / 0 Closed / 2 Full Tide Open
Flashboard Status : In
Boat Lock Status : Open

California Hydrologic Conditions: (California Cooperative Snow Surveys Forecast, May 1, 2013)

Previous Month's Index (8RI for April.): 2.023 MAF
Water Year Type: Dry
Sacramento valley water year type index (40/30/30) @ 50%:5.8 MAF (Dry)
San Joaquin valley water year type index (60/20/20) @ 75%: 1.6 MAF (Critical)

Electrical Conductivity (EC) in milliSiemens per Centimeter.
Chlorides (Cl) in milligrams per liter
mhl - mean high tides
md - mean daily
14 dm - fourteen day running mean
28 dm - twenty-eight day running mean
NR - No Record
NC - Average not computed due to insufficient data.
BR : Below Rating
e - estimated value

Montezuma Slough Gate Operation:
Number of gates operating at either Open, Closed, or Full Tide Open
Flashboard Status : In, Out, or Modified In
Boat Lock Status : Open or Closed

Coordinated Operation Agreement Delta Status:
e = excess Delta conditions
b = balanced Delta cond. w/ no storage withdrawal
s = balanced Delta cond. w/ storage withdrawal
Excess Delta conditions with restrictions:
f = fish concerns
r = E/I ratio concerns

* NDOI, Rio Vista & Vernalis Flows:
- Monthly average is progressive daily mean.
- 7 day average is progressive daily mean for the first six days of the month.

Delta Water Quality Conditions

Date	Antioch Tides High	Antioch Tides Half	Net Delta Outflow Index cfs	Martinez mdEC	Port Chicago mdEC	Port Chicago 14dm	Mallard mdEC	Chipps Island mdEC	Chipps Island 14dm	Collinsville mdEC	Collinsville 14dm
04/20/2013	4.93	3.50	8,211	18.80	11.88	7.15	4.52	3.99	1.64	1.65	0.55
04/21/2013	5.12	3.57	7,471	21.29	13.71	7.53	6.22	5.68	1.90	2.35	0.66
04/22/2013	5.33	3.66	7,059	22.73	15.38	8.08	6.75	6.22	2.20	3.03	0.85
04/23/2013	5.73	3.88	6,849	24.39	15.62	8.80	7.88	7.37	2.65	4.18	1.12
04/24/2013	6.07	4.19	6,605	25.78	18.18	9.65	9.64	9.43	3.23	5.31	1.47
04/25/2013	6.47	4.25	7,038	26.40	18.77	10.49	10.63	10.27	3.86	6.13	1.88
04/26/2013	6.32	4.08	7,896	25.52	17.32	11.21	9.19	8.74	4.38	5.33	2.22
04/27/2013	6.31	4.02	9,030	24.92	16.30	11.84	8.76	8.29	4.86	4.95	2.54
04/28/2013	6.36	4.08	10,396	24.58	15.35	12.44	8.30	7.81	5.31	4.66	2.84
04/29/2013	6.40	4.24	10,578	24.44	14.82	12.96	8.21	7.72	5.75	4.38	3.11
04/30/2013	6.24	4.15	10,798	23.98	13.59	13.56	7.92	7.42	6.21	4.37	3.40
05/01/2013	5.84	3.99	11,146	22.44	11.37	14.10	6.67	6.13	6.60	3.97	3.66
05/02/2013	5.30	3.75	11,614	21.84	12.15	14.52	6.15	5.61	6.93	2.99	3.85
05/03/2013	5.51	3.82	10,635	21.60	12.21	14.73	6.64	6.10	7.20	3.02	4.02
05/04/2013	6.13	4.17	9,908	22.78	12.84	14.84	7.67	7.16	7.42	3.97	4.19
05/05/2013	6.32	4.48	9,485	25.15	12.95	14.79	9.37	8.93	7.66	5.28	4.40
05/06/2013	6.15	4.19	9,388	24.14	11.38	14.50	8.18	7.69	7.76	4.51	4.50
05/07/2013	6.06	4.10	9,350	23.80	11.10	14.17	8.04	7.54	7.77	4.44	4.52
05/08/2013	6.01	4.07	9,129	24.07	10.98	13.65	8.21	7.71	7.65	4.37	4.46
05/09/2013	6.05	4.08	9,695	23.57	9.40	12.98	7.95	7.45	7.45	4.07	4.31
05/10/2013	6.06	4.08	10,994	22.85	8.69	12.37	7.50	6.98	7.32	3.91	4.21
05/11/2013	6.04	4.03	11,743	21.76	7.75	11.76	6.63	6.09	7.17	3.39	4.10
05/12/2013	5.98	4.06	11,661	20.78	7.95	11.23	6.40	5.87	7.03	3.28	4.00
05/13/2013	5.94	4.12	11,402	21.10	7.48	10.70	6.19	5.65	6.88	3.12	3.91
05/14/2013	5.80	4.16	11,153	21.37	6.97	10.23	6.22	5.68	6.76	2.89	3.80
05/15/2013	5.72	4.15	10,114	21.13	5.60	9.82	6.14	5.60	6.72	2.74	3.71
05/16/2013	5.26	4.02	9,550	21.54	2.97	9.16	5.75	5.21	6.69	2.87	3.70
05/17/2013	5.18	3.95	8,987	21.04	2.33	8.46	5.39	4.85	6.60	1.99	3.63
05/18/2013	5.07	3.63	9,399	18.61	2.09	7.69	4.55	4.02	6.38	1.69	3.47
05/19/2013	5.27	3.48	9,727	18.03	1.99	6.91	4.14	3.62	6.00	1.52	3.20

Antioch Tides measured in feet above mean sea level.
Net Delta Ouflow Index calculated from equation as specified in D-1641, revised June 1995.
Chipps Island EC calculated from measurements recorded at Mallard Slough.
Electrical Conductivity (EC) units: milliSiemens per Centimeter
md : mean daily
14dm : fourteen day running mean
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e - estimated value

Delta Water Quality Conditions

Date	Antioch		Jersey Point		Emmaton		Cache Slough	Good Year Slough	Sunrise Club	Volanti Slough	Beldon Landing	Collinsville
	mdEC	14mdEC	mdEC	14mdEC	mdEC	14mdEC	mdEC	mhtEC	mhtEC	mhtEC	mhtEC	mhtEC
04/20/2013	0.39	0.42	0.23	0.25	0.20	0.20	0.39	5.83	5.06	5.62	5.55	2.04
04/21/2013	0.61	0.42	0.24	0.25	0.22	0.20	0.40	5.92	5.40	6.19	5.60	3.56
04/22/2013	0.87	0.44	0.24	0.25	0.25	0.20	0.42	6.13	5.97	6.77	5.93	4.39
04/23/2013	1.16	0.49	0.25	0.25	0.29	0.21	0.42	6.94	7.31	8.39	7.40	5.37
04/24/2013	1.93	0.60	0.30	0.25	0.71	0.25	0.42	8.71	8.59	10.03	9.00	6.92
04/25/2013	2.36	0.74	0.36	0.26	1.28	0.32	0.43	9.73	8.79	10.32	9.24	7.42
04/26/2013	1.91	0.85	0.33	0.26	1.06	0.39	0.43	10.74	9.36	10.77	9.23	6.54
04/27/2013	1.87	0.95	0.34	0.27	1.00	0.44	0.42	11.60	9.71	11.16	9.59	5.86
04/28/2013	1.93	1.06	0.35	0.27	0.89	0.49	0.43	11.74	9.83	10.73	10.02	5.61
04/29/2013	2.04	1.17	0.36	0.28	0.75	0.53	0.45	11.84	10.00	11.33	10.34	5.73
04/30/2013	1.90	1.28	0.37	0.29	0.64	0.56	0.46	11.91	9.92	11.63	10.50	5.40
05/01/2013	1.33	1.35	0.35	0.30	0.35	0.57	0.51	11.90	9.76	11.44	10.86	4.69
05/02/2013	1.28	1.42	0.32	0.31	0.35	0.58	0.46	11.85	9.95	11.16	10.66	3.35
05/03/2013	1.29	1.49	0.33	0.31	0.38	0.60	0.46	11.87	9.85	11.30	9.99	4.36
05/04/2013	1.55	1.57	0.36	0.32	0.44	0.61	0.48	11.74	10.13	10.74	9.79	5.88
05/05/2013	2.21	1.69	0.44	0.34	0.76	0.65	0.42	11.59	9.35	10.94	9.73	6.92
05/06/2013	1.87	1.76	0.39	0.35	0.67	0.68	0.42	11.57	9.68	10.53	8.64	5.54
05/07/2013	1.71	1.80	0.37	0.36	0.62	0.71	0.43	11.61	9.25	9.83	7.57	5.72
05/08/2013	1.66	1.78	0.36	0.36	0.63	0.70	0.45	11.84	8.67	9.42	7.11	5.77
05/09/2013	1.63	1.73	0.36	0.36	0.61	0.65	0.48	11.79	8.13	9.21	6.63	5.27
05/10/2013	1.48	1.70	0.35	0.36	0.57	0.62	0.50	11.99	7.76	8.60	6.49	5.24
05/11/2013	1.32	1.65	0.34	0.36	0.46	0.58	0.48	12.11	7.49	8.22	6.05	4.24
05/12/2013	1.32	1.61	0.34	0.36	0.41	0.54	0.45	11.82	7.10	7.63	5.50	4.49
05/13/2013	1.18	1.55	0.34	0.36	0.37	0.52	0.45	11.36	6.59	7.07	4.94	3.93
05/14/2013	1.12	1.50	0.34	0.36	0.34	0.50	0.43	11.33	6.13	6.45	4.24	4.30
05/15/2013	1.11	1.48	0.33	0.35	0.37	0.50	0.42	11.16	5.72	5.97	3.88	3.56
05/16/2013	1.03	1.46	0.32	0.35	0.32	0.50	0.40	10.60	5.18	5.67	3.68	
05/17/2013	0.91	1.44	0.31	0.35	0.29	0.49	NR	10.25	5.10	5.62	3.53	3.14
05/18/2013	0.74	1.38	0.30	0.35	0.25	0.48	NR	10.12	5.04	5.56	3.31	2.43
05/19/2013	0.70	1.27	0.29	0.34	0.23	0.44	NR	9.95	4.98	5.51	2.97	2.33

Electrical Conductivity (EC) units: milliSiemens per Centimeter
Chloride (Cl) units: milligrams per liter
mht : mean high tides
md : mean daily
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e : estimated value

Delta Water Quality Conditions

Date	Bethel Island mdEC	Farrar Park mdEC	Holland Tract mdEC	Bacon Island mdEC	Contra Costa mdEC	Clifton Court mdEC	Tracy Pumping Plant mdEC	Antioch mdCl	Bacon Island mdCl	Contra Costa mdCl	Delta Status
04/20/2013	0.25	0.29	0.28	0.27	0.34	0.57	0.75	54	33	37	f
04/21/2013	0.25	0.29	0.25	0.27	0.32	0.51	0.68	124	32	38	f
04/22/2013	0.24	0.29	0.25	0.27	0.33	0.46	0.60	206	32	37	f
04/23/2013	0.24	0.29	0.25	0.27	0.33	0.43	0.50	298	31	37	f
04/24/2013	0.25	0.28	0.25	0.27	0.32	0.40	0.49	545	31	37	f
04/25/2013	0.26	0.27	0.25	0.26	0.32	0.38	0.42	683	31	36	s
04/26/2013	0.26	0.29	0.26	0.27	0.31	0.35	0.43	537	32	36	s
04/27/2013	0.25	0.29	0.26	0.26	0.32	0.32	0.40	524	34	38	s
04/28/2013	0.26	0.29	0.26	0.28	0.32	0.32	0.35	544	35	38	s
04/29/2013	0.26	0.30	0.26	0.28	0.29	0.31	0.32	581	35	38	s
04/30/2013	0.28	0.30	0.26	0.28	0.31	0.34	0.33	535	34	36	s
05/01/2013	0.27	0.29	0.26	0.27	0.30	0.32	0.33	352	32	36	s
05/02/2013	0.28	0.29	0.21	0.27	0.31	0.33	0.32	337	32	34	s
05/03/2013	0.28	0.29	0.23	0.27	0.31	0.33	0.31	341	32	35	s
05/04/2013	0.28	0.30	0.27	0.27	0.30	0.32	0.31	424	32	35 e	s
05/05/2013	0.29	0.31	0.28	0.28	0.29	0.30	0.28	635	34	35 e	s
05/06/2013	0.29	0.31	0.28	0.28	0.29	0.25	0.28	525	35	33	s
05/07/2013	0.29	0.32	0.28	0.29	0.29	0.24	NR	475	37	33	s
05/08/2013	0.30	0.33	0.29	0.29	0.28	0.24	NR	458	38	33	s
05/09/2013	0.30	0.33	0.29	0.30	0.30	0.25	NR	448	40	34	s
05/10/2013	0.31	0.34	0.30	0.30	0.30	0.26	NR	400	41	35	s
05/11/2013	0.31	0.33	0.30	0.31	0.29	0.28	NR	351	42	35 e	s
05/12/2013	0.31	0.34	0.30	0.31	0.31	0.29	NR	351	43	35 e	s
05/13/2013	0.31	0.33	0.31	0.32	0.32	0.31	NR	307	44	37	s
05/14/2013	0.31	0.33	0.31	0.32	0.32	0.30	NR	288	45	39	s
05/15/2013	0.31	0.34	0.31	0.32	0.32	0.32	NR	283	45	36	s
05/16/2013	0.31	0.34	0.31	0.32	NR	0.34	NR	257	45	40	s
05/17/2013	0.31	0.34	0.31	0.32	NR	0.35	NR	220	46	42	s
05/18/2013	0.31	0.34	0.31	0.33	NR	0.36	NR	166	47	42 e	s
05/19/2013	0.31	0.34	0.31	0.33	NR	0.39	NR	151	47	42 e	s

Electrical Conductivity (EC) units: milliSiemens per Centimeter
Chloride (Cl) units: milligrams per liter
md : mean daily
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e : estimated value
Antioch and Bacon Island mdCl are calculated from the respective mdEC values.

Coordinated Operation Agreement Delta Status:
c = excess Delta conditions
b = balanced Delta cond. w/ no storage withdrawal
s = balanced Delta cond. w/ storage withdrawal
Excess Delta conditions with restrictions:
f = fish concerns
r = E/I ratio concerns

Delta Water Quality Conditions

South Delta Stations

Date	Vernalis		Brandt Bridge		Old River Near Tracy		Old River Near Middle River	
	md EC	30 day avg	md EC	30 day avg	md EC	30 day avg	md EC	30 day avg
04/20/2013	0.39	0.79	0.52	0.88	0.90	1.10	0.40	0.87
04/21/2013	0.30	0.77	0.41	0.86	0.76	1.09	0.43	0.85
04/22/2013	0.30	0.75	0.42	0.84	0.64	1.08	0.33	0.84
04/23/2013	0.27	0.72	0.32	0.82	0.62	1.07	0.31	0.81
04/24/2013	0.25	0.70	0.30	0.80	0.47	1.05	0.26	0.79
04/25/2013	0.24	0.68	0.24	0.78	0.41	1.02	0.22	0.77
04/26/2013	0.24	0.65	0.22	0.76	0.34	1.00	0.21	0.74
04/27/2013	0.23	0.62	0.21	0.73	0.38	0.97	0.21	0.72
04/28/2013	0.23	0.60	0.21	0.71	0.38	0.94	0.21	0.69
04/29/2013	0.22	0.58	0.21	0.68	0.37	0.91	0.20	0.66
04/30/2013	0.22	0.56	0.20	0.66	0.35	0.88	0.20	0.64
05/01/2013	0.21	0.54	0.20	0.64	0.32	0.85	0.20	0.61
05/02/2013	0.21	0.52	0.20	0.61	0.36	0.82	0.19	0.59
05/03/2013	0.20	0.50	0.20	0.59	0.36	0.80	0.20	0.57
05/04/2013	0.19	0.47	0.19	0.57	0.31	0.77	0.18	0.55
05/05/2013	0.18	0.45	0.18	0.55	0.27	0.74	0.17	0.52
05/06/2013	0.19	0.43	0.17	0.52	0.25	0.72	0.17	0.50
05/07/2013	0.20	0.41	0.18	0.50	0.28	0.69	0.18	0.48
05/08/2013	0.20	0.39	0.20	0.48	0.31	0.67	0.20	0.45
05/09/2013	0.22	0.37	0.20	0.45	0.30	0.64	0.21	0.43
05/10/2013	0.22	0.35	0.22	0.43	0.29	0.62	NR	NC
05/11/2013	0.21	0.33	0.23	0.41	0.29	0.59	NR	NC
05/12/2013	0.21	0.31	0.22	0.38	0.29	0.56	NR	NC
05/13/2013	0.22	0.29	0.22	0.36	0.30	0.53	0.23	NC
05/14/2013	0.26	0.28	0.24	0.34	0.30	0.50	0.25	NC
05/15/2013	0.33	0.27	0.27	0.32	0.31	0.48	0.29	NC
05/16/2013	0.38	0.26	0.32	0.30	0.36	0.45	0.37	NC
05/17/2013	0.40	0.26	0.37	0.28	0.43	0.43	0.44	NC
05/18/2013	0.44	0.26	0.44	0.27	0.47	0.42	0.47	NC
05/19/2013	0.48	0.26	0.47	0.27	0.54	0.40	0.51	NC

Electrical Conductivity (EC) units: milliSiemens per Centimeter
md : mean daily
NR : No Record
NC : Average not computed due to insufficient data
BR : Below Rating
e : estimated value

State of California - Department of Water Resources - Division of Operations & Maintenance - Operations Control Office

Delta Hydrology Conditions

Date	Sacramento River at Freeport + SRWTP cfs	Yolo Bypass cfs	East Side Streams cfs	San Joaquin River at Vernalis cfs	Rainfall inches	Clifton Court Forebay Intake cfs	Tracy Pumping Plant cfs	CCWD Pumping Plants cfs	Barker Slough Pumping Plant cfs	BBID Diversion cfs
4/20/2013	8,441	395	591	2,334	0.00	1,193	807	25	56	0
4/21/2013	7,858	398	548	2,645	0.00	1,494	810	25	62	0
4/22/2013	7,645 e	410	519	2,678	0.00	1,694	810	25	62	200
4/23/2013	7,194	439	529	2,935	0.00	1,690	813	25	48	73
4/24/2013	6,360	496	559	3,414	0.00	1,695	821	26	72	72
4/25/2013	7,006	530	570	3,582	0.00	996	817	25	70	67
4/26/2013	8,078	529	542	3,675	0.00	991	815	25	65	53
4/27/2013	9,423	585	502	3,765	0.00	995	814	24	78	66
4/28/2013	10,870	594	509	3,893	0.00	963	815	24	77	0
4/29/2013	11,478	602	512	4,130	0.00	2,421	815	26	83	66
4/30/2013	12,147	616	500	4,064	0.00	2,998	817	27	83	0
5/1/2013	12,415	623	479	3,954	0.00	3,193	814	152	88	66
5/2/2013	11,495	629	463	3,952	0.00	494	3,155	176	94	63
5/3/2013	10,056	623	466	4,043	0.00	494	3,082	226	117	67
5/4/2013	9,028	660	478	4,176	0.00	1,492	1,353	240	96	0
5/5/2013	8,414	665	456	4,105	0.00	1,490	937	245	84	0
5/6/2013	8,445	648	445	3,970	0.00	993	982	245	91	159
5/7/2013	8,390	616	456	3,838	0.00	793	980	243	84	91
5/8/2013	9,212	557	479	3,689	0.00	792	979	243	84	77
5/9/2013	10,884	510	484	3,561	0.00	793	978	257	84	70
5/10/2013	11,824	486	468	3,549	0.00	999	978	261	98	72
5/11/2013	12,068	450	478	3,509	0.00	993	983	258	101	0
5/12/2013	11,480	446	479	3,439	0.00	993	982	260	109	0
5/13/2013	11,425	500	451	3,376	0.00	993	980	266	110	206
5/14/2013	10,836	553	416	2,828	0.00	993	980	252	99	76
5/15/2013	10,923	603	400	2,090	0.00	992	979	236	97	86
5/16/2013	10,499	579	410	1,678	0.00	993	863	207	92	84
5/17/2013	11,073	605	445	1,521	0.00	688	811	190	103	65
5/18/2013	11,534	643	439	1,423	0.00	689	808	185	112	0
5/19/2013	11,854	618	418	1,309	0.00	699	808	202	103	0

SRWTP : Sacramento Regional Water Treatment Plant effluent.
Yolo Bypass : combined measurements of Cache Creek at Rumsey and Freemont Weir.
East Side Streams : combined stream flows of Cosumnes River at Michigan Bar, Mokelumne River at Woodbridge, miscellaneous streams estimated from Dry Creek at Galt (discontinued since Dec. 1997), and Calaveras River based on releases from New Hogan Dam.
Rainfall : incremental daily precipitation measured at Stockton Fire Station #4.
CCWD Pumping Plants : combined pumping at the Old River, Rock Slough and Middle River Plants.

State of California - Department of Water Resources - Division of Operations & Maintenance - Operations Control Office

Delta Hydrology Conditions

Date	Banks Pumping Plant cfs	Delta Gross Channel Depletions cfs	Rio Vista Flow cfs	QWEST cfs	Net Delta Outflow Index cfs	Percent of Inflow Diverted 3 day	14 day	Delta Status
4/20/2013	1,161	1,900	7,029	1,372	8,211	13.3%	10.4%	f
4/21/2013	1,504	1,900	6,352	1,313	7,471	16.4%	12.6%	f
4/22/2013	1,504	1,900	5,850	1,404	7,059	18.7%	14.2%	f
4/23/2013	1,779	1,900	5,677	1,353	6,849	20.5%	15.7%	f
4/24/2013	1,504	1,950	5,301	1,512	6,605	21.3%	16.7%	f
4/25/2013	810	1,950	4,635	2,609	7,038	20.0%	16.0%	s
4/26/2013	895	1,950	5,229	2,868	7,898	17.7%	14.8%	s
4/27/2013	587	1,950	6,158	3,087	9,030	14.8%	13.4%	s
4/28/2013	985	2,000	7,366	3,247	10,396	13.6%	13.7%	s
4/29/2013	1,684	2,000	8,619	2,181	10,578	15.6%	17.3%	s
4/30/2013	2,348	2,000	9,164	1,856	10,798	18.7%	22.5%	s
5/1/2013	3,279	2,000	9,758	1,616	11,146	21.9%	27.7%	s
5/2/2013	1,123	2,000	9,998	1,850	11,614	22.0%	28.2%	s
5/3/2013	1,034	2,050	9,192	1,704	10,635	21.5%	26.9%	s
5/4/2013	1,864	2,100	7,925	2,226	9,906	20.2%	23.9%	s
5/5/2013	2,095	2,100	7,070	2,646	9,485	19.1%	20.8%	s
5/6/2013	596	2,100	6,543	3,083	9,388	16.4%	16.6%	s
5/7/2013	0	2,150	6,539	3,045	9,350	14.3%	13.7%	s
5/8/2013	0	2,150	6,459	2,905	9,129	12.8%	11.9%	s
5/9/2013	138	2,200	7,099	2,835	9,695	12.5%	11.5%	s
5/10/2013	1,101	2,200	8,501	2,745	10,994	12.4%	11.8%	s
5/11/2013	1,101	2,250	9,278	2,723	11,743	12.2%	12.2%	s
5/12/2013	1,101	2,300	9,440	2,891	11,861	12.1%	12.6%	s
5/13/2013	1,101	2,300	8,928	2,746	11,402	11.7%	12.3%	s
5/14/2013	1,015	2,350	8,918	2,498	11,153	11.7%	12.2%	s
5/15/2013	1,101	2,350	8,504	1,872	10,114	12.0%	12.2%	s
5/16/2013	930	2,400	8,577	1,233	9,550	12.5%	12.4%	s
5/17/2013	732	2,450	8,167	1,095	8,987	12.2%	11.6%	s
5/18/2013	732	2,450	8,690	992	9,399	11.5%	10.8%	s
5/19/2013	732	2,500	9,114	892	9,727	10.9%	10.2%	s

Delta Gross Channel Depletions from Dayflow Table 3.
Rio Vista Flow calculated from Dayflow equation.
QWEST calculated from Dayflow equation.
Net Delta Outflow Index calculated from equation as specified in D-1641, revised June 1995.

Coordinated Operation Agreement Delta Status:
- c = excess Delta conditions
- b = balanced Delta cond. w/ no storage withdrawal
- s = balanced Delta cond. w/ storage withdrawal
- Excess Delta conditions with restrictions:
  - f = fish concerns
  - r = E/I ratio concerns

EXHIBIT B

Nomellini, Grilli McDaniel PLCs

From: Grober, Les@Waterboards [Les.Grober@waterboards.ca.gov]
Sent: Wednesday, May 29, 2013 8:40 AM
To: ngmplcs@pacbell.net
Subject: FW: USBR and DWR request re delta standards

Attachments: Milligan,R. -2013-05_SWRCB Water Right Decision 1641 Water Year Classification.pdf; CDFW concurrence with proposed changes to Delta WQ standards requested by DWR and Reclamation; NMFS support for change petition to D-1641; FWS concurrence with proposed changes to Delta WQ standards, as requested by Reclamation and DWR; RE: NMFS support for change petition to D-1641

Milligan,R. 3-05_SWRCB W | CDFW rence with prop | NMFS support r change petiti | FWS rence with prop | RE: NMFS port for change

Dante,

Here is the email I sent Melinda yesterday. The last attachment is the email response from Tom.

Les

From: Grober, Les@Waterboards
Sent: Tuesday, May 28, 2013 4:35 PM
To: 'Melinda Terry (melinda@northdw.com)'
Cc: Riddle, Diane@Waterboards
Subject: USBR and DWR request re delta standards

Melinda,

It was nice chatting with you. As we discussed, attached are the following emails/letters: the USBR/DWR request, emails from three fishery agencies, and Tom Howard's 5/24 response to the emails we had received at that point from NMFS and CDFW, as we had not yet gotten a request from USBR/DWR.

I'll send you a copy of the follow-up letter from Craig Wilson, the Delta Watermaster, tomorrow.

Please call or email if you have questions.

Les

Leslie F. Grober, Assistant Deputy Director Hearings and Special Programs Branch Division of Water Rights State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Telephone: (916) 341-5428
Fax: (916) 341-5400
E-mail: lgrober@waterboards.ca.gov<mailto:lgrober@waterboards.ca.gov>

BUREAU OF RECLAMATION
Central Valley Operation Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

DEPARTMENT OF WATER RESOURCES
Division of Operations and Maintenance
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

MAY 24 2013

IN REPLY REFER TO:
CVO-100
WTR-4.10

Thomas Howard
Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, California 95814

Subject: State Water Resources Control Board Water Right Decision 1641 Water Year Classification

Dear Mr. Howard:

The Department of Water Resources (DWR) and the United States Bureau of Reclamation (Reclamation) request that the State Water Resources Control Board (SWRCB) acknowledge that the water year classification for the Sacramento Valley based on the equation provided in Attachment 1, page 188 of Revised Water Rights Decision 1641 (D-1641) does not accurately reflect the unprecedented dry conditions experienced in 2013. Instead, the hydrologic conditions experienced between January and the present are characteristic of a "Critical" water year type. The current miscategorization in water year classification is projected to affect the storage of cold water pool for fisheries purposes due to controlling D-1641 Delta objectives in the May through August period. These objectives are:

1) EC parameters for Sacramento River at Emmaton (Interagency Station Number D-22), San Joaquin River at Jersey Point (Interagency Station Number D-15), South Fork Mokelumne River at Terminous (Interagency Station Number C-13), and San Joaquin River at San Andreas (interagency Station Number C-4) as defined in Table 2 on page 182
2) Delta Outflow, as defined on Table 3 on Page 184.

Water year classification also affects other objectives listed in D-1641 to a lesser degree, but it is not anticipated that those objectives will significantly control Delta operations in 2013.

Summary of Relevant Facts:

D-1641 imposes water quality objectives on the Central Valley Project (CVP) and State Water Project (SWP). Several of the objectives are dependent on the water year type as determined by the May 1, Sacramento Valley Index and the San Joaquin Valley Index. Although the January through April period during 2013 was the driest on record, the November and December precipitation was sufficient to result in a Sacramento Valley classification of "Dry" for water year 2013. The "Dry" water year classification is not representative of the extreme hydrological conditions in Northern California this calendar year and the water quality objectives based on this water year type could result in significant adverse impacts to the cold water pool operations at Shasta Reservoir. In fact, Governor Brown's recent executive order B-21-13 recognizes that, "much of California experienced record dry conditions in January through March 2013, registering historic lows on the Northern Sierra" and "record dry and warm conditions resulted in a snowpack substantially below average, with estimated May water content in the statewide snowpack being only 17 percent of average."

The 2013 water year has been particularly challenging with double the normal precipitation in November and December and historically low values from January into May. The current Northern Sierra 8 Station Precipitation Index from January 1, 2013 through May 15 is about 8.8 inches. Without additional measurable precipitation in May, this figure will represent the driest Northern Sierra 8-Station Precipitation Index for the January through May period on record. Attachment 1 shows the accumulated 8-station precipitation values from January through May for some of the extremely dry years including 1924, 1976, and 1977. The nearly 80 percent of this year's precipitation occurred in the first three months of the water year, and an abnormally large portion of this fell as rain rather than snow as a result of warmer than normal conditions for that time of year. This combined with critically dry conditions in the months since the first of the year has resulted in minimal snow pack in the Sierra Nevada in the critical spring months. The Northern Sierra snowpack was only about 48% of the historical April 1 value and about 17% of normal as of May 1, 2013. Creek and small stream flows that enter the Sacramento River system below major reservoirs are running at historically low levels in response to the extended dry period. DWR's May 1, 2013 Bulletin 120 forecasts an April to July runoff 48% of normal for the Sacramento Valley. Hydrological conditions are not likely to improve and the National Oceanic and Atmospheric Administration has indicated that California is in severe to extreme drought that is likely to persist or intensify into the summer (Attachment 2).

Additionally, unusually high depletions in the Sacramento Valley are adding to the operational challenges the CVP and SWP (collectively, Projects) are facing in meeting the 2013 water year type requirements. Typically, extremely dry years with low Northern Sierra 8-Station Precipitation Index values trigger the Shasta inflow shortage criteria included in water rights settlement contracts that would reduce water supplies for the senior water rights diverters in the Sacramento Valley. Yet, this year the wetter conditions in the fall months were sufficient to require full allocations to the Sacramento Valley and Feather River settlement contractors, increasing demands on Shasta and Oroville storage. Therefore, it is expected that depletions will continue to run at a high rate into the summer. DWR and Reclamation are required to make releases in order to satisfy the senior water rights of the Sacramento River and Feather River settlement contractors, and the Exchange Contractors. These contracts specify the amount of water the Projects must deliver – for the Sacramento River and Exchange Contractors, Reclamation is required to deliver 100% of the contract total in any year where the forecasted inflow to Shasta Reservoir exceeds 3.2 million acre feet (af). This target was met in 2013 – thus Reclamation is mandated to deliver 100% of the contract total, and has no discretion under the contract to reduce these deliveries.

The unusually high stream depletions (Attachment 3) were a major cause of the exceedence of the Emmaton objective that occurred in April and May. This is described in further detail in DWR and Reclamation's letter to SWRCB dated May 24, 2013. The CVP and SWP reservoir systems were in a near normal condition in January, but Reclamation and DWR have drawn heavily on the storage since then due to the extended dry period, low unregulated flow entering the system, and high depletions in the Central Valley. Reservoir releases are currently well above average for this date.

In order to meet the Dry year water quality objectives rather than the Critical objectives, DWR and Reclamation have released significant volumes of water from Oroville, Shasta, and Folsom Reservoirs. The low reservoir inflow and increased storage withdrawal is depleting the cold water pool in the reservoirs that is important to provide adequate instream fishery habitat for anadromous fish in the rivers through the summer and fall.

SWRCB Water Rights Order 90-05 requires that Reclamation operate Shasta Reservoir to meet a daily average temperature of 56 degrees Fahrenheit in the Sacramento River at a location and through periods when higher temperatures will be detrimental to the fishery. Typically, through coordination with the Sacramento River Temperature Task Group (SRTTG), the location selected is between Balls Ferry and Bend Bridge on the Sacramento River. Without recognition of the Sacramento Valley water year type actually experienced in 2013, the projected low reservoir storage and limited cold water pool this year may result in the objective occurring well upstream of Balls Ferry and Reclamation is concerned whether the 56 degree objective can be maintained at any location in the Sacramento River through the fall. The cold water pool is vital to providing adequate habitat to salmon present in the Sacramento River through the summer and into the fall for both the winter-run Chinook salmon and fall-run Chinook salmon. The SRTTG has recommended an initial temperature compliance point of Airport Road located upstream of Balls Ferry due to the limited cold water resources this year.

Due to the unprecedented hydrologic conditions discussed above including the record dry January through May period, extremely low snowpack, and unusually high Sacramento valley depletions, conditions continue to deteriorate and it is clear that meeting the dry year objectives could jeopardize the ability to meet other fisheries objectives later in the year. The reservoir storage that accumulated in the wet fall, which was originally projected to be sufficient to meet the dry year objectives, is falling rapidly due to the abnormally large valley demands and

Reclamation is projecting CVP September carryover storages only about 63% of average.

There is a significant difference between the volume of Delta inflow needed to achieve the Dry and Critical water quality objectives for Jersey Point and Emmation through June 15. If Reclamation and DWR are able to begin operating to the Critical year water quality objectives in May it may be possible to achieve 100,000 to 200,000 af, of cold water benefits in the upstream reservoirs. This savings in cold water storage would improve the chances of meeting the temperature objective at Airport Road. This cold water benefit will help avoid temperature related fish losses in the Sacramento River.

The greatest benefits to the Project's reservoir storage would occur in the May to August 15 period. The compliance locations in the Western Delta and Interior Delta shown in Table 3 on Page 182 (Sacramento River at Emmaton (Interagency Station Number D-22), San Joaquin River at Jersey Point (Interagency Station Number D-15), South Fork Mokelumne River at Terminous (Interagency Station Number C-13), and San Joaquin River at San Andreas Landing (Interagency Station Number C-4) would most likely be the objectives controlling the Project operations during the May to June 15 period and changes at these locations would have the greatest impact on improving upstream storage in the immediate future. The objectives of the Delta outflow compliance location in Table 3 on page 184 often can control Project operations through the summer and operating to a critical year with respect to Delta outflow will also assist in preserving cold water pool.

Currently, DWR and Reclamation are maintaining a Net Delta Outflow well over 9,000 cubic feet per second (cfs) in order to achieve the Dry year objectives for Jersey Point and Emmaton. If the Dry classification is changed to Critical, the controlling D-1641 objective through June would be the Net Delta Outflow Index of at least 7,100 cfs in Table 3, or the export to inflow ratio of 35% in Table 3. From July through August 15, the controlling criteria for either water year classification would most likely shift among the minimum Net Delta Outflow objectives in Table 3, the salinity objectives for Jersey Point and Emmaton in Table 2, the Export to Inflow ratio of 65% in Table 3, or the Contra Costa 250 chloride objective in Table 1.

Table 2 of D-1641 requires an electrical conductivity (EC) no greater than 0.45 mmhos/cm for both Emmaton and Jersey point locations from April 1 to June 15, and 1.67 mmhos/cm for Emmaton and 1.35 mmhos/cm for Jersey Point from June 15 to August 15 under a Dry Year classification. For a Critical year these objectives are 2.78 mmhos/cm from April 1 to August 15 for Jersey Point and Emmaton. Since the X2 outflow objective of 7,100 cfs, which is not linked to the year type designation would probably control in May, and June, there would only be a gradual increase in salinity at Jersey Point and Emmaton through June that is reflective of a Critical year. Water quality at Jersey Point and Emmaton would fluctuate with the tidal and meteorological conditions potentially moving towards a 1.0 to 2.0 mmhos/cm EC range in July. Compliance with the water quality objectives at the Jersey Point and Emmaton locations typically achieves the objectives at Terminous and San Andreas Landing. This gradual increase in salinity levels would be commensurate with those experienced in years with similar hydrologic conditions as those observed in recent months.

Reclamation estimates that from May through August 15 a change in the water year classification from Dry to Critical in the Western Delta and Interior Delta locations in Table 2 could result in a gain of about 115,000 af, in upstream reservoir carryover storage at the end of September. Including the Delta outflow compliance in Table 3 for the same period would increase the gain in reservoir carryover storage to about 185,000 af. There could be reductions in the release from Keswick Reservoir up to about 1,000 cubic feet second in late May and June under a Critical year classification.

D-1641 requires that the number of days less than or equal to 150 mg/l chloride at Contra Costa Pumping Plant be greater than 165 days for a Dry year and 155 days for a Critical year. DWR and Reclamation do not anticipate that this objective would be a controlling criteria for the Projects under either year classification and both objectives would be met. The minimum Net Delta Outflow required from February through June (Collinsville X2 at 7,100 cfs) should be adequate to achieve the Contra Costa objective under either the Dry or Critical classification.

SWRCB recognition of the change in water year type is in the public interest. The change will provide for a water year classification reflective of the extremely dry hydrologic conditions in 2013 and allow the projects to operate in a manner that will provide the maximum benefit to critical beneficial users without unreasonably affecting other designated beneficial uses. As noted above there will be no significant impacts to agricultural or municipal uses, and the change will provide significant benefit to fisheries resources. State and federal agencies have been focused on the protection and improvement of fishery conditions in the Delta watershed, and are in the process of analyzing options for balancing project operations for the numerous different beneficial uses. Approval of the following request would result in water quality conditions in the North Delta that are consistent with the hydrology we are currently experiencing, while preserving cold water storage critical to salmon survival.

Requested Action:
Reclamation and DWR request that the SWRCB recognize the change in year classification need and act immediately. Delaying such recognition to even June 1 will significantly impair Reclamation's ability to meet cold water temperature objectives on the Sacramento River. At present, the controlling D-1641 Delta water quality objectives for the Projects that are linked to the Sacramento Valley Index are Jersey Point in Table 2, Emmaton in Table 2. In addition, Delta Outflow in Table 3, may become a controlling standard and will also impact cold water pool storage starting in the middle of June.

We believe the SWRCB may balance protection of the beneficial uses in light of the critical water year type experienced on the Sacramento River in 2013. Immediate benefits to cold water pool storage can be achieved through the Projects meeting critical water year standards for the Interior and Western Delta salinity standards in Table 2. The compliance points at issue are Sacramento River at Emmaton (Interagency Station Number D-22), San Joaquin River at Jersey

Point (Interagency Station Number D-15), South Fork Mokelumne River at Terminous (Interagency Station Number C-13), and San Joaquin River at San Andreas Landing (Interagency Station Number C-4).

Additional cold water pool benefits can be achieved in July through September with recognition of the critical water year type in Table 3, Water Quality Objectives for Fish and Wildlife Beneficial Uses. As noted above; Delta outflow objectives will likely control project operations in July through September, where agricultural objectives are met under a critical water year designation. A Delta outflow standard reflective of the critical water year type may produce an additional 70,000 af of cold water pool storage.

If you have any questions or would like more information regarding this notification, please contact Mr. Paul Fujitani of Reclamation at 916-979-2197 or Mr. John Leahigh at 916-574-2722.

Sincerely,

Ronald Milligan

Ronald Milligan, Operations Manager
Central Valley Operations Office
U.S. Bureau of Reclamation

for D. Roose

David H. Roose, Chief
SWP Operations Control Office
Department of Water Resources

Attachment -4

cc: Mr. Craig M. Wilson, Delta Watermaster
State Water Resources Control Board
1001 I Street
Sacramento, California 95812

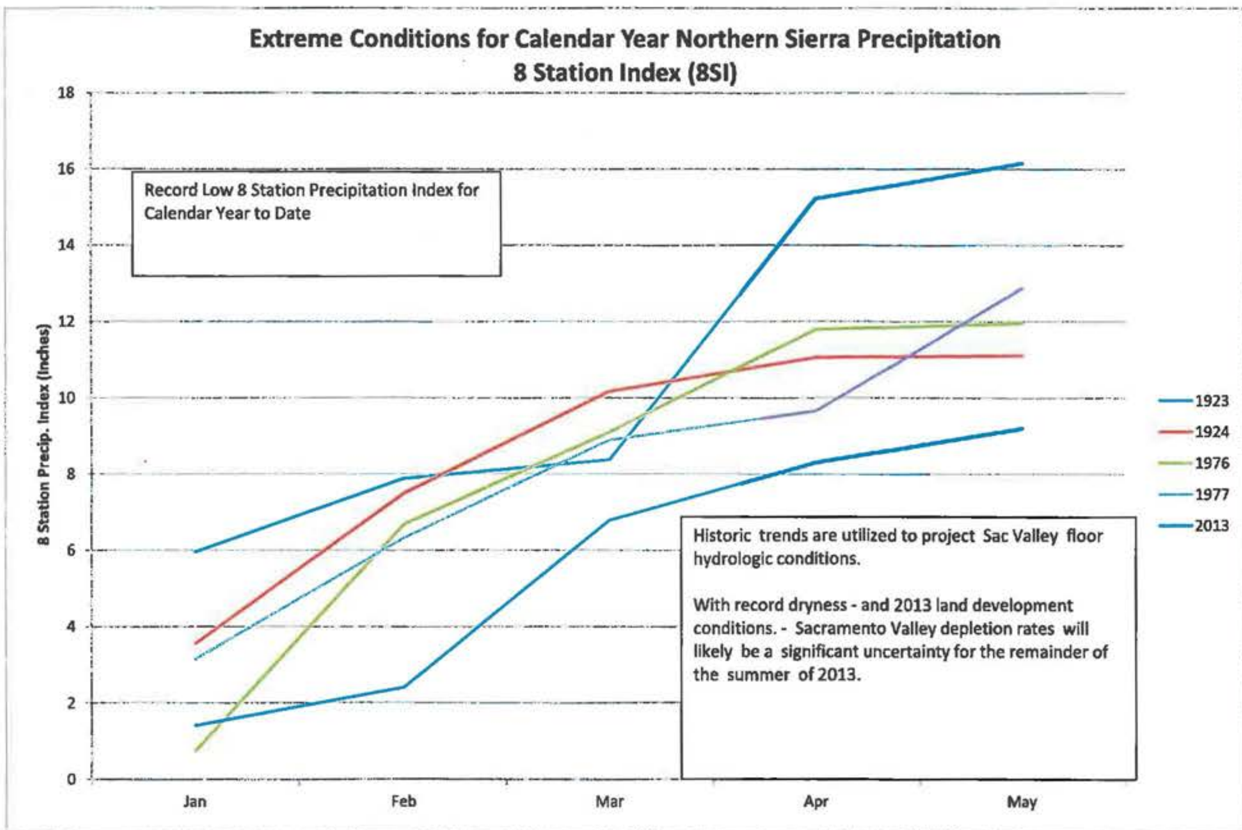
Ms. Maria Rae
Central Valley Office Supervisor
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, California 95814

Mr. Les Grober
State Water Resources Control Board
Division of Water Rights
1001 I Street
Sacramento, California 95812
(w/encl to each)

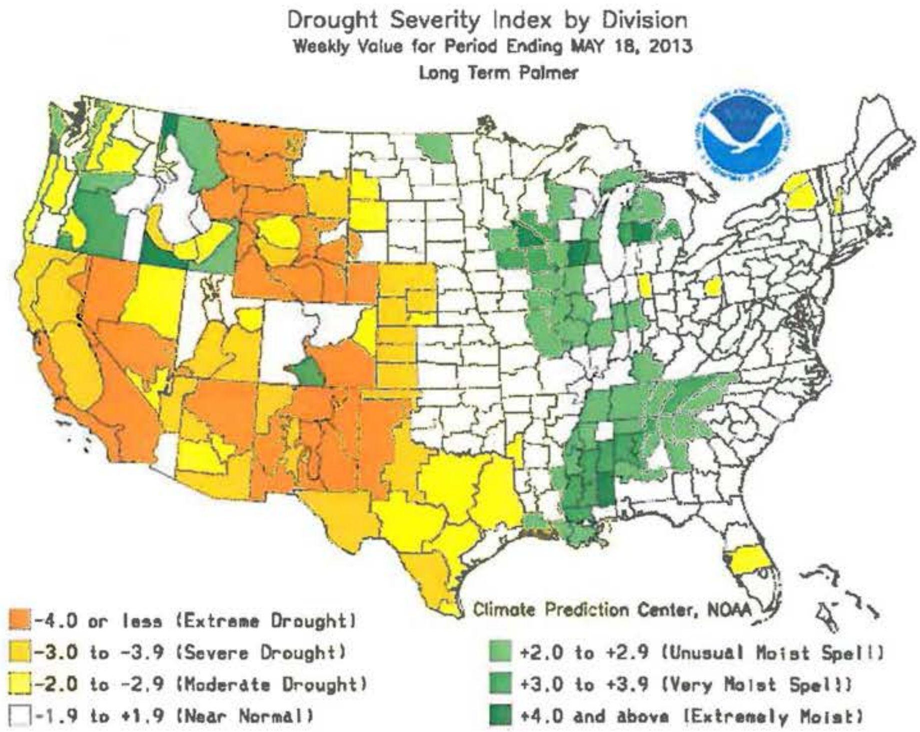
Carl Wilcox
California Department of Fish and Wildlife
1416 9th Street
Sacramento, California 95814

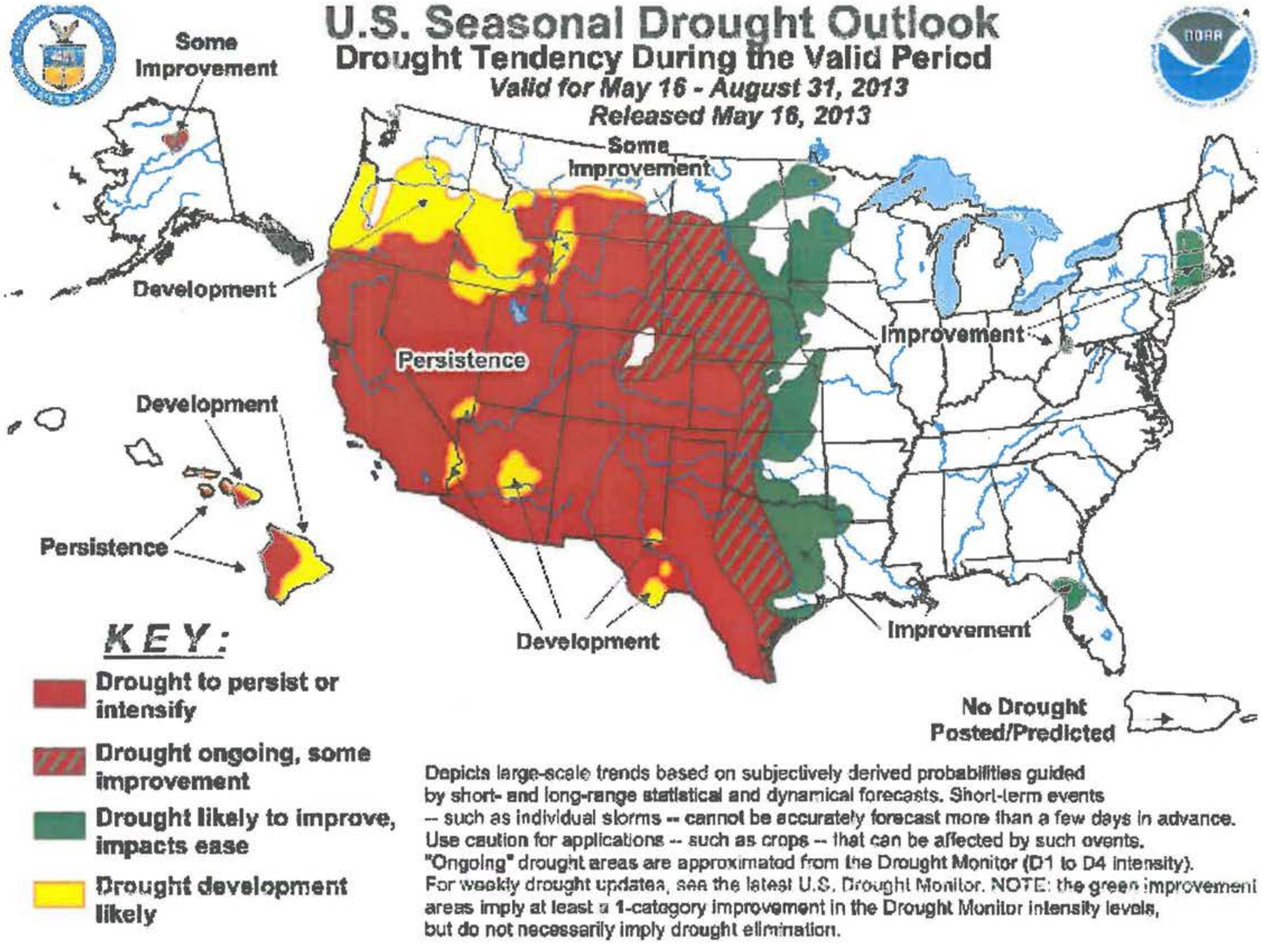
Ms. Kim Turner
Assistant Field Supervisor
Bay-Delta Fish & Wildlife Office
U.S. Fish & Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

Attachment 1



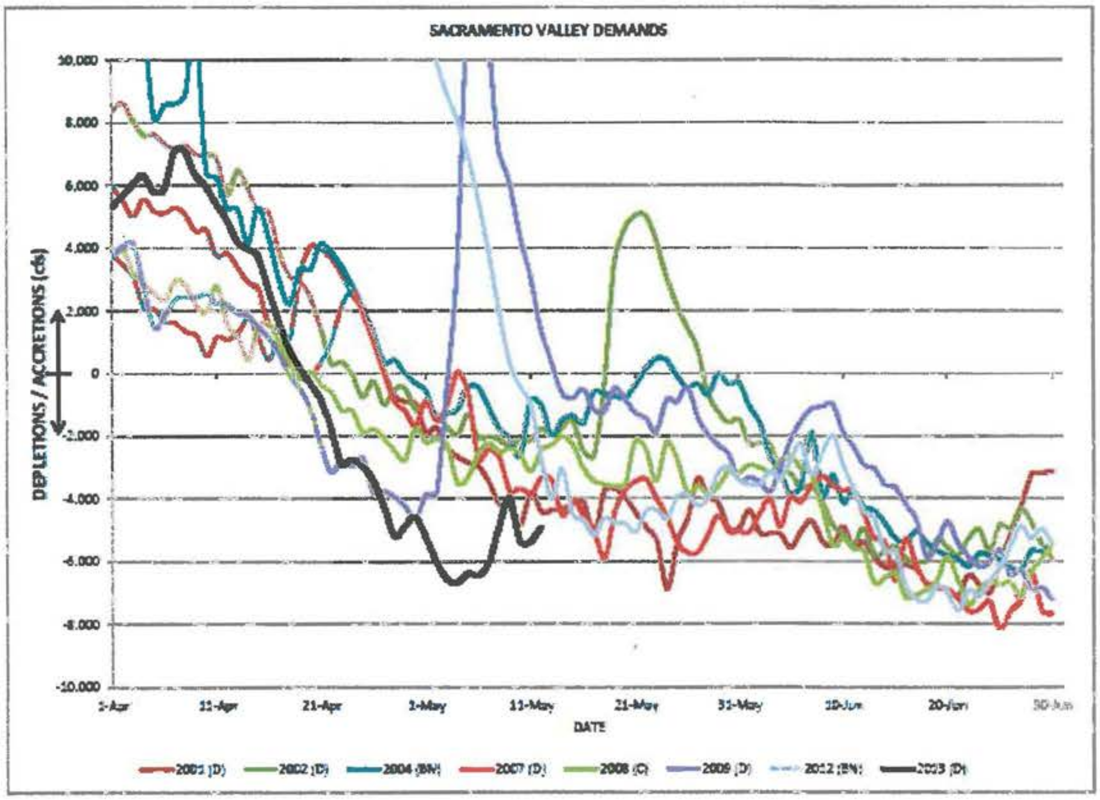
Attachment 2





Attachment 3

Attachment 4



From:	Wilcox, Carl@Wildlife [Carl.Wilcox@wildlife.ca.gov]
Sent:	Friday, May 24, 2013 4:04 PM
To:	Marcus, Felicia@Waterboards; Howard, Tom@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards
Cc:	Riddle, Diane@Waterboards; Leahigh, John@DWR; pfujitani@usbr.gov; Dibble, Chad@Wildlife; Maria Rea - NOAA Federal; Garwin.Yip@noaa.gov; Jennifer_norris@fws.gov; Kim_S_Turner@fws.gov
Subject:	CDFW concurrence with proposed changes to Delta WQ standards requested by DWR and Reclamation

Board Chair Marcus,

This e-mail is to provide California Department of Fish & Wildlife (CDFW) support/concurrence regarding the U.S. Bureau of Reclamation's (Reclamation) and California Department of Water Resources' (DWR) proposal that the SWRCB change the Sacramento Valley Water Year Hydrologic Classification Index (40-30-30) water year type from "dry" to "critical" as it pertains to the Water Quality Objectives for Agricultural Beneficial Uses under D-1641 at the following Western Delta and Interior Delta monitoring stations:

* Sacramento River at Emmaton, Station D-22;
* San Joaquin River at Jersey Point, Station D-15;
* South Fork Mokelumne River at Terminus, Station C-13; and
* San Joaquin River at San Andreas Landing, Station C-4.

This request is to support applying the new water year classification as soon as possible, through August 15, 2013. The biggest benefit to changing the water year type for the specific water quality stations is increased storage in (or conversely, reducing the rate of drawdown of) Shasta Reservoir. This will likely benefit the life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014.

The proposal was discussed on a conference call today, Friday, May 24, among members of the SWRCB, Reclamation, DWR, U.S. Fish and Wildlife Service (USFWS), CDFW, and National Marine Fisheries Service (NMFS). In addition, the fish agencies conferred on the proposal and concur. The USFWS and NMFS will send separate e-mails expressing their support for the proposal. It is our understanding that a letter making the subject request will be forthcoming this afternoon. CDFW is providing this email concurrence to allow for a timely decision to maximize protection of Shasta storage to protect Chinook salmon. Any change in the formal submission by DWR and Reclamation to the SWRCB this afternoon from what is described above, will require re-evaluation by the CDFW before we could provide our concurrence.

Carl Wilcox
Policy Advisor to the Director for the Delta California Department of Fish and Wildlife
7329 Silverado Trail
Napa, CA 94558
Cell 707-738-4134
Office 707-944-5584
Carl.Wilcox@wildlife.ca.gov

Nomellini, Grilli & McDaniel PLCs

From: Maria Rea - NOAA Federal [maria.rea@noaa.gov]

Sent: Friday, May 24, 2013 4:50 PM

To: Marcus, Felicia@Waterboards; Howard, Tom@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards; Riddle, Diane@Waterboards

Cc: Garwin.Yip@noaa.gov; RMILLIGAN@usbr.gov; pfujitani@usbr.gov; Leahigh, John@DWR; Dan_Castleberry@r1. Gov; Wilcox, Carl@Wildlife

Subject: NMFS support for change petition to D-1641

Dear Felicia and Tom:

This e-mail is to provide NOAA's National Marine Fisheries Service's (NMFS) support/concurrence regarding the U.S. Bureau of Reclamation's (Reclamation) and California Department of Water Resources' (DWR) proposal. As I understand it, and as discussed on a conference call this morning among members of the SWRCB, Reclamation, DWR, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and NMFS, Reclamation and DWR will request that the SWRCB change the Sacramento Valley Water Year Hydrologic Classification Index (40-30-30) water year type from "dry" to "critical" as it pertains to the Water Quality Objectives for Agricultural Beneficial Uses under D-1641 at the following Western Delta and Interior Delta monitoring stations:

- Sacramento River at Emmaton, Station D-22;
- San Joaquin River at Jersey Point, Station D-15;
- South Fork Mokelumne River at Terminus, Station C-13; and
- San Joaquin River at San Andreas Landing, Station C-4.

This request is to support applying the new water year classification as soon as possible, through August 15, 2013. The biggest benefit to changing the water year type for the specific water quality stations is increased storage in (or conversely, reducing the rate of drawdown of) Shasta Reservoir. This will likely benefit the life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014. For example, Reclamation is currently releasing 13,000 cfs from Keswick Dam partly as a result of the Delta Cross Channel being open over the Memorial Day weekend and partly because of the spring tide, but largely to maintain compliance with the Emmaton water quality standard. In addition, the May forecast at the 90% exceedance hydrology indicates that the projected end of September (EOS) carryover storage at Shasta Reservoir is 1.527 million acre feet (MAF). The NMFS biological opinion on the long-term operations of the Central Valley Project and State Water Project does not have a minimum EOS carryover storage requirement in Shasta Reservoir. However, although the requirements in Action I.2.3.C pertain to the February forecast, it does acknowledge and provide for drought exception procedures if a Clear Creek Temperature Compliance Point or 1.9 MAF EOS storage is not achievable, indicating that the forecasted carryover storage of 1.527 MAF is very low.

In addition, the fish agencies conferred on the proposal as discussed this morning, and also concur. The USFWS and CDFW will send separate e-mails expressing their support for the proposal.

Please let me know if you have any questions or need more information. My cell phone number is (916) 799-2359.

- Maria

Maria Rea
Supervisor, Central Valley Office, NOAA Fisheries

Nomellini, Grilli & McDaniel PLCs

From: michael_chotkowski@fws.gov

Sent: Tuesday, May 28, 2013 2:08 PM

To: Marcus, Felicia@Waterboards; Howard, Tom@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards

Cc: Riddle, Diane@Waterboards; Leahigh, John@DWR; pfujitani@usbr.gov; Dibble, Chad@Wildlife; Maria Rea - NOAA Federal; Garwin.Yip@noaa.gov; Jennifer_norris@fws.gov; Kim_S_Turner@fws.gov

Subject: FWS concurrence with proposed changes to Delta WQ standards, as requested by Reclamation and DWR

Board Chair Marcus,

This email expresses the U.S. Fish and Wildlife Service's (Service) support for the State Water Board's proposal to implement the U.S. Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR) request to change the 40-30-30 Sacramento Valley water year type from "dry" to "critical," specifically as it pertains to relaxing the D-1641 water quality objectives for agricultural beneficial uses at four stations in the western Delta:

* Sacramento River at Emmaton, Station D-22;
* San Joaquin River at Jersey Point, Station D-15;
* South Fork Mokelumne River at Terminus, Station C-13; and
* San Joaquin River at San Andreas Landing, Station C-4.

The proposed change to the water year type for the specific water quality stations would reduce drawdown of Shasta Reservoir. This will likely benefit the early life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014. In this unusual year, the biological benefits to imperiled salmon appear large enough to outweigh our concern about the potentially adverse effects of the concomitant reduction in Delta outflow during these months.

The change in EC standard at these stations would occur immediately and last through August 15, 2013. The Service supports implementation of the proposal on a one-time basis that reflects unusual winter-run Chinook concerns this year, so long as implementation does not affect management of OMR flow to protect juvenile delta smelt in accordance with the Service's 2008 OCAP Biological Opinion.

The Service will continue to work cooperatively with its Federal and State partners to ensure that the CVP and SWP operations provide adequate protection for Threatened and Endangered species while delivering water that benefits 25 million agricultural and urban water users throughout California.

Mike Chotkowski
Field Supervisor, Bay-Delta Fish and Wildlife Office
650 Capitol Mall
Sacramento, CA 95814
(916) 930-5632

Nomellini, Grilli & McDaniel PLCs

From: Howard, Tom@Waterboards [Tom.Howard@waterboards.ca.gov]

Sent: Friday, May 24, 2013 5:56 PM

To: Maria Rea - NOAA Federal; Marcus, Felicia@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards; Riddle, Diane@Waterboards

Cc: Garwin.Yip@noaa.gov; RMILLIGAN@usbr.gov; pfujitani@usbr.gov; Leahigh, John@DWR; Dan_Castleberry@r1. Gov; Wilcox, Carl@Wildlife

Subject: RE: NMFS support for change petition to D-1641

In the interest of making the best use of limited water supplies, and maintaining cold water pool storage in Shasta Reservoir, I want to provide a timely initial response to emails from the National Marine Fisheries Service and the California Department of Fish and Wildlife (fish agencies). The fish agencies support a change in the Sacramento Valley Water Year Hydrologic Classification Index (40-30-30) water year type from "dry" to "critical" as it pertains to the Water Quality Objectives for Agricultural Beneficial Uses under D-1641 at the following Western Delta and Interior Delta monitoring stations:

- Sacramento River at Emmaton, Station D-22;
- San Joaquin River at Jersey Point, Station D-15;
- South Fork Mokelumne River at Terminus, Station C-13; and
- San Joaquin River at San Andreas Landing, Station C-4.

The State Water Board staff will not recommend any action if the projects operate to meet the critically dry year objectives for Western and Central Delta agricultural objectives, instead of operating to meet dry year objectives through August 15, 2013. Our intent to not take any action is conditioned on submittal of a temperature management plan pursuant to State Water Board Order 90-5 within one week of May 28, operation in accordance with the plan, and any further conditions determined by the Executive Director of the State Water Board. Furthermore, the Projects will be required to include an accounting of operations under the change in water year classification.

I will follow-up with an expanded response on Tuesday May 28 after receipt of any requests related to these Delta operations from the Department of Water resources and the United States Bureau of Reclamation.

I believe in the future that more timely exchange of information regarding operational issues will alleviate situations of this nature.

From: Maria Rea - NOAA Federal [mailto:maria.rea@noaa.gov]
Sent: Friday, May 24, 2013 4:50 PM
To: Marcus, Felicia@Waterboards; Howard, Tom@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards; Riddle, Diane@Waterboards
Cc: Garwin.Yip@noaa.gov; RMILLIGAN@usbr.gov; pfujitani@usbr.gov; Leahigh, John@DWR; Dan_Castleberry@r1. Gov; Wilcox, Carl@Wildlife
Subject: NMFS support for change petition to D-1641

Dear Felicia and Tom:
This e-mail is to provide NOAA's National Marine Fisheries Service's (NMFS) support/concurrence regarding the U.S. Bureau of Reclamation's (Reclamation) and California Department of Water Resources' (DWR) proposal. As I understand it, and as discussed on a conference call this morning among members of the SWRCB, Reclamation, DWR, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and NMFS, Reclamation and DWR will request that the SWRCB change the Sacramento Valley Water Year Hydrologic Classification Index (40-30-30)

water year type from "dry" to "critical" as it pertains to the Water Quality Objectives for Agricultural Beneficial Uses under D-1641 at the following Western Delta and Interior Delta monitoring stations:

- Sacramento River at Emmaton, Station D-22;
- San Joaquin River at Jersey Point, Station D-15;
- South Fork Mokelumne River at Terminus, Station C-13; and
- San Joaquin River at San Andreas Landing, Station C-4.

This request is to support applying the new water year classification as soon as possible, through August 15, 2013. The biggest benefit to changing the water year type for the specific water quality stations is increased storage in (or conversely, reducing the rate of drawdown of) Shasta Reservoir. This will likely benefit the life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014. For example, Reclamation is currently releasing 13,000 cfs from Keswick Dam partly as a result of the Delta Cross Channel being open over the Memorial Day weekend and partly because of the spring tide, but largely to maintain compliance with the Emmaton water quality standard. In addition, the May forecast at the 90% exceedance hydrology indicates that the projected end of September (EOS) carryover storage at Shasta Reservoir is 1.527 million acre feet (MAF). The NMFS biological opinion on the long-term operations of the Central Valley Project and State Water Project does not have a minimum EOS carryover storage requirement in Shasta Reservoir. However, although the requirements in Action I.2.3.C pertain to the February forecast, it does acknowledge and provide for drought exception procedures if a Clear Creek Temperature Compliance Point or 1.9 MAF EOS storage is not achievable, indicating that the forecasted carryover storage of 1.527 MAF is very low.

In addition, the fish agencies conferred on the proposal as discussed this morning, and also concur. The USFWS and CDFW will send separate e-mails expressing their support for the proposal.

Please let me know if you have any questions or need more information. My cell phone number is (916) 799-2359.

- Maria

Maria Rea
Supervisor, Central Valley Office, NOAA Fisheries

EXHIBIT C

Nomellini, Grilli _McDaniel PLCs

From: Grober, Les@Waterboards [Les.Grober@waterboards.ca.gov]
Sent: Thursday, May 30, 2013 10:16 AM
To: Terry, Melinda @northdw.com; ngmplcs@pacbell.net
Subject: FW: May 29 2013 Letter to USBR and DWR on Actions to Conserve Cold Water Pool

Attachments: signed response letter 5-29-13.pdf; Milligan,R. -2013-05_SWRCB Water Right Decision 1641 Water Year Classification.pdf

signed Milligan,R.
›nse letter 5-29-3-05_SWRCB W

Here is the follow-up letter.

From: Saechao, Dramy@Waterboards
Sent: Wednesday, May 29, 2013 5:12 PM
To: Roose, David@DWR; RMILLIGAN@usbr.gov
Cc: Howard, Tom@Waterboards; maria.rea@noaa.gov; Wilcox, Carl@Wildlife; Kim_S_Turner@fws.gov; Foresman.Erin@epamail.epa.gov; Terry, Melinda @northdw.com; ngmplcs@pacbell.net; pfujitani@usbr.gov; Leahigh, John@DWR
Subject: May 29 2013 Letter to USBR and DWR on Actions to Conserve Cold Water Pool

Please see the attached May 29, 2013 letter from Craig Wilson, the Delta Watermaster, to the U.S. Bureau of Reclamation and California Department of Water Resources regarding actions to conserve cold water pool in Shasta Reservoir for fishery resources. The letter from the Bureau and Department is also attached.

Questions regarding this matter should be directed to Craig Wilson at cwilson@waterboards.ca.gov<mailto:cwilson@waterboards.ca.gov> or 916-445-5962.

CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

State Water Resources Control Board

Ronald Milligan, Operations Manager
Central Valley Operations Office
U.S. Bureau of Reclamation
3310 El Camino Avenue, Suite 300
Sacramento, CA 95821

David H. Roose, Chief
SWP Operations Control Office
California Department of Water Resources
Division of Operations and Maintenance
3310 El Camino Avenue, Suite 300
Sacramento, CA 95821

Dear Messrs. Milligan and Rosse:

ACTIONS TO CONSERVE COLD WATER POOL IN SHASTA RESERVOIR FOR FISHERY RESOURCES

This letter responds to your May 24, 2013 letter to Thomas Howard, Executive Director for the State Water Resources Control Board (State Water Board) regarding unprecedented dry conditions in the Sacramento Valley and needed actions to protect cold water pool (CWP) resources for fisheries purposes. In your letter you request that the State Water Board acknowledge that the water year classification for the Sacramento Valley contained in State Water Board Decision 1641 (D-1641, Figure 1, page 188) does not accurately reflect the unprecedented dry conditions that have occurred since January of this year, which are characteristic of a critically dry year determination. Specifically, you propose that the Bureau and Department comply with critically dry water year requirements for certain Delta water quality objectives instead of dry year requirements in order to conserve CWP resources in Shasta Reservoir needed to protect Chinook salmon this season.

<u>Background</u>

The State Water Board was first contacted regarding this matter on May 17, 2013, by Maria Rea, Supervisor of the Central Valley Office of the National Marine Fisheries Service (NOAA Fisheries). Ms. Rea emailed Mr. Howard expressing concerns that planned Shasta Reservoir releases to meet Delta water quality objectives required by D-1641 would impact winter-run Chinook salmon by depleting already low Shasta Reservoir CWP resources. Ms. Rea requested that the agencies meet as soon as possible to discuss this matter.

In the midst of these discussions, on May 20, 2013, Governor Edmund G. Brown Jr. issued an Executive Order (B-21-13) outlining California's exceptionally dry water year conditions and ordering that the Department and the State Water Board expedite the review of water transfers to address the dry conditions and water delivery limitations. As outlined in Executive Order B-21-13:

- much of California experienced record dry conditions in January through March 2013, registering historic lows on the Northern Sierra and the San Joaquin precipitation indices; and

- record dry and warm conditions resulted in a snowpack substantially below average, with estimated May water content in the statewide snowpack being only 17 percent of average and with the spring snowmelt season now being well underway.

On May 22, 2013, State Water Board staff met with staff from the Bureau and Department to discuss possible Shasta Reservoir CWP actions. On May 24, 2013, State Water Board staff again met with staff from the Department and Bureau as well as staff from NOAA Fisheries, the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Wildlife (CDFW) (collectively fisheries agencies) to discuss Shasta Reservoir CWP actions. The fisheries agencies agreed on the need to take actions to conserve CWP resources in Shasta Reservoir and concurred with a proposal that the Department and Bureau operate to meet critically dry year requirements for the Western and Interior Delta water quality objectives for the protection of agriculture included in Table 2 of D-1641 (page 182), which include the following stations:

- Sacramento River at Emmaton, Station D-22;
- San Joaquin River at Jersey Point, Station D-15;
- South Fork Mokelumne River at Terminus, Station C-13; and
- San Joaquin River at San Andreas Landing, Station C-4.

The fisheries agencies requested additional time and discussion to consider any further actions related to Delta outflow or other requirements due to potential fisheries related impacts. On May 24 , 2013, Carl Wilcox of the CDFW and Maria Rea of NOAA Fisheries sent emails to State Water Board staff in support of the proposal that the Bureau and Department operate to meet critically dry year conditions for the above mentioned Western and Interior Delta compliance stations through August 15, 2013 (attached). On May 28, 2013, Michael Chotkowski with the USFWS also submitted an email of support for the changes mentioned above (attached).

Prior to receipt of your letter on May 24, 2013, Mr. Howard sent an initial response regarding this matter indicating that, in the interest of making the best use of limited water supplies and maintaining cold water pool storage in Shasta Reservoir, the State Water Board staff will not recommend taking any action if the projects operate to meet the critically dry year objectives for the Western and Interior Delta agricultural objectives, instead of operating to meet dry year objectives through August 15, 2013. Mr. Howard indicated that the intent to not take any action was conditioned on submittal of a temperature management plan pursuant to State Water Board Order 90-5 within one week of May 28, 2013, and operation in accordance with the plan, and any further conditions determined by the Executive Director of the State Water Board. Mr. Howard also indicated that the Bureau and Department will be required to include a water accounting under the change in operations. Mr. Howard indicated that we would follow up after receipt of a specific request from the Bureau and Department.

<u>Proposal</u>

In your letter you propose to meet critically dry year requirements pursuant to D-1641 for the Sacramento Valley, including requirements included in Table 3 for the protection of fish and wildlife, in order to conserve CWP resources. In your letter, you state that, although the January through April period during 2013 was the driest on record, the November and December precipitation was sufficient to result in a Sacramento Valley classification of "dry" for water year 2013. Your letter further states that nearly 80 percent of this water year's precipitation occurred in October, November and December 2012, and an abnormally large portion of this fell as rain rather than snow as a result of warmer than normal conditions for that time of year. This combined with critically dry conditions in the months since the first of the year has resulted in minimal snow pack in the Sierra Nevada in the critical spring months. As of May 1, 2013, the Northern Sierra snowpack was only about 48 percent of the historical April 1 value and about 17 percent of normal. Further, you point out that unusually high stream depletions in the Sacramento Valley have also contributed to reduced storage levels.

Your letter explains that meeting dry year objectives could jeopardize the Bureau and Department's ability to meet objectives designed to protect fisheries later in the year. In particular, the Bureau has expressed concern that it may not be able meet the temperature requirement necessary to protect salmon present in the Sacramento River during the summer and fall if the CWP in Shasta Reservoir continues to be depleted. You state that operating to meet critically dry water year requirements for the Western and Interior Delta from May through August 15 of this year could result in a gain of approximately 115 thousand acre-feet (TAF) of water in upstream reservoirs at the end of September. You indicate that including the Delta outflow requirement (included in Table 3 of D-1641) for the same period would increase the gain in reservoir carryover storage to approximately 185 TAF. You further indicate that compliance with critically dry conditions will result in water quality conditions in the North Delta that are consistent with the current hydrology.

<u>Response to Proposal</u>

Article X, section 2 of the California Constitution sets forth a directive to maximize the reasonable and beneficial use of the State's waters. As such, this constitutional mandate provides an important consideration where statutory water rights provisions vest discretion in the State Water Board. We have reviewed the unique factors of your request and the recommendations of the fisheries agencies. As the person delegated by the State Water Board to act on water right permit terms that apply to conditions in the Delta, I will not object or take any action if the Bureau and Department operate to meet critically dry year objectives for Western and Interior Delta agricultural beneficial uses included in Table 2 of D-1641 instead of operating to meet dry year objectives through August 15, 2013. This conclusion is conditioned as specified in the above mentioned email from the State Water Board's Executive Director Thomas Howard. Specifically, the Bureau and Department shall submit a temperature management plan pursuant to State Water Board Order 90-5 **by June 4, 2013**, and shall operate in accordance with the approved plan to maximize temperature benefits to fisheries resources. The Bureau and Department shall consult with the fisheries agencies concerning temperature management decisions and shall immediately inform the State Water Board regarding any fisheries agencies concerns and proposed resolution of those concerns. The Bureau and Department shall implement additional actions as determined by me or the Executive Director of the State Water Board. The Bureau and Department shall also submit a water accounting to the State Water Board under the change in operations **by August 22, 2013**.

I understand that Delta outflow requirements are not currently controlling operational decisions related to releases from Shasta Reservoir, but likely will be in the next several weeks. In order to determine whether any additional changes to operations to meet Delta outflow or other objectives required by D-1641 should be made to protect CWP resources, the Bureau and Department should immediately consult with the fisheries agencies and State Water Board staff.

I will consider additional actions to conserve CWP resources upon receipt of input from the fisheries agencies on those matters.

In the future, the State Water Board staff and I expect discussions regarding compliance matters to begin as soon as potential issues are identified in order to allow the greatest flexibility to address these issues. The State Water Board will consider whether appropriate coordination took place in a timely manner when considering future enforcement action.

If you have any questions, please contact me at cwilson@waterboards.ca.gov or 916-445-5962. Written correspondence should be addressed as follows:

State Water Resources Control Board
Office of Delta Watermaster
Attn: Craig Wilson
P.O. Box 100
Sacramento, CA 95812

Sincerely,

Craig M. Wilson

Craig Wilson, Delta Watermaster
State Water Resources Control Board

Enclosures

cc: Thomas Howard, Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, CA 95812

Maria Rea,Central Valley Office Supervisor
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

Carl Wilcox
California Department of Fish and Wildlife
1416 9th Street
Sacramento, CA 95814

Kim Turner, Assistant Field Supervisor
U.S. Fish & Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814

cc: Continues on next page.

cc: Erin Foresman
USEPA Region 9
C/O NMFS 650 Capitol Mall
Sacramento, CA 95814

Melinda Terry, Manager
North Delta Water Agency
910 K Street, Suite 310
Sacramento, CA 95814

Dante Nomellini Jr.
Central Delta Water Agency
P.O. Box 1461
Stockton, CA 95201

Paul Fujitani
U.S. Bureau of Reclamation
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

John Leahigh
California Department of Water Resources
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

From: Wilcox, Carl@Wildlife [mailto:Carl.Wilcox@wildlife.ca.gov]
Sent: Friday, May 24, 2013 4:04 PM
To: Marcus, Felicia@Waterboards; Howard, Tom@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards
Cc: Riddle, Diane@Waterboards; Leahigh, John@DWR; pfujitani@usbr.gov; Dibble, Chad@Wildlife; Maria Rea - NOAA Federal; Garwin.Yip@noaa.gov; Jennifer_norris@fws.gov; Kim_S_Turner@fws.gov
Subject: CDFW concurrence with proposed changes to Delta WQ standards requested by DWR and Reclamation

Board Chair Marcus,

This e-mail is to provide California Department of Fish & Wildlife (CDFW) support/concurrence regarding the U.S. Bureau of Reclamation's (Reclamation) and California Department of Water Resources' (DWR) proposal that the SWRCB change the Sacramento Valley Water Year Hydrologic Classification Index (40-30-30) water year type from "dry" to "critical" as it pertains to the Water Quality Objectives for Agricultural Beneficial Uses under D-1641 at the following Western Delta and Interior Delta monitoring stations:

* Sacramento River at Emmaton, Station D-22;
* San Joaquin River at Jersey Point, Station D-15;
* South Fork Mokelumne River at Terminus, Station C-13; and
* San Joaquin River at San Andreas Landing, Station C-4.

This request is to support applying the new water year classification as soon as possible, through August 15, 2013. The biggest benefit to changing the water year type for the specific water quality stations is increased storage in (or conversely, reducing the rate of drawdown of) Shasta Reservoir. This will likely benefit the life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014.

The proposal was discussed on a conference call today, Friday, May 24, among members of the SWRCB, Reclamation, DWR, U.S. Fish and Wildlife Service (USFWS), CDFW, and National Marine Fisheries Service (NMFS). In addition, the fish agencies conferred on the proposal and concur. The USFWS and NMFS will send separate e-mails expressing their support for the proposal. It is our understanding that a letter making the subject request will be forthcoming this afternoon. CDFW is providing this email concurrence to allow for a timely decision to maximize protection of Shasta storage to protect Chinook salmon. Any change in the formal submission by DWR and Reclamation to the SWRCB this afternoon from what is described above, will require re-evaluation by the CDFW before we could provide our concurrence.

Carl Wilcox
Policy Advisor to the Director for the Delta California Department of Fish and Wildlife
7329 Silverado Trail
Napa, CA 94558
Cell 707-738-4134
Office 707-944-5584
Carl.Wilcox@wildlife.ca.gov

From: Maria Rea - NOAA Federal [mailto:maria.rea@noaa.gov]
Sent: Friday, May 24, 2013 4:50 PM
To: Marcus, Felicia@Waterboards; Howard, Tom@Waterboards; Wilson, Craig@Waterboards; Grober, Les@Waterboards; Riddle, Diane@Waterboards
Cc: Garwin.Yip@noaa.gov; RMILLIGAN@usbr.gov; pfujitani@usbr.gov; Leahigh, John@DWR; Dan_Castleberry@r1. Gov; Wilcox, Carl@Wildlife
Subject: NMFS support for change petition to D-1641

Dear Felicia and Tom:

This e-mail is to provide NOAA's National Marine Fisheries Service's (NMFS) support/concurrence regarding the U.S. Bureau of Reclamation's (Reclamation) and California Department of Water Resources' (DWR) proposal. As I understand it, and as discussed on a conference call this morning among members of the SWRCB, Reclamation, DWR, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and NMFS, Reclamation and DWR will request that the SWRCB change the Sacramento Valley Water Year Hydrologic Classification Index (40-30-30) water year type from "dry" to "critical" as it pertains to the Water Quality Objectives for Agricultural Beneficial Uses under D-1641 at the following Western Delta and Interior Delta monitoring stations:

- Sacramento River at Emmaton, Station D-22;
- San Joaquin River at Jersey Point, Station D-15;
- South Fork Mokelumne River at Terminus, Station C-13; and
- San Joaquin River at San Andreas Landing, Station C-4.

This request is to support applying the new water year classification as soon as possible, through August 15, 2013. The biggest benefit to changing the water year type for the specific water quality stations is increased storage in (or conversely, reducing the rate of drawdown of) Shasta Reservoir. This will likely benefit the life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014. For example, Reclamation is currently releasing 13,000 cfs from Keswick Dam partly as a result of the Delta Cross Channel being open over the Memorial Day weekend and partly because of the spring tide, but largely to maintain compliance with the Emmaton water quality standard. In addition, the May forecast at the 90% exceedance hydrology indicates that the projected end of September (EOS) carryover storage at Shasta Reservoir is 1.527 million acre feet (MAF). The NMFS biological opinion on the long-term operations of the Central Valley Project and State Water Project does not have a minimum EOS carryover storage requirement in Shasta Reservoir. However, although the requirements in Action I.2.3.C pertain to the February forecast, it does acknowledge and provide for drought exception procedures if a Clear Creek Temperature Compliance Point or 1.9 MAF EOS storage is not achievable, indicating that the forecasted carryover storage of 1.527 MAF is very low.

In addition, the fish agencies conferred on the proposal as discussed this morning, and also concur. The USFWS and CDFW will send separate e-mails expressing their support for the proposal.

Please let me know if you have any questions or need more information. My cell phone number is (916) 799-2359.

- Maria

Maria Rea

Supervisor, Central Valley Office, NOAA Fisheries

From: "Chotkowski, Michael" <michael_chotkowski@fws.gov>
Date: May 28, 2013 6:21:50 PM PDT
To: <Felicia.Marcus@waterboards.ca.gov>, <Tom.Howard@waterboards.ca.gov>, <Craig.Wilson@waterboards.ca.gov>, <Les.Grober@waterboards.ca.gov>
Cc: <Diane.Riddle@waterboards.ca.gov>, "Leahigh, John@DWR" <John.Leahigh@water.ca.gov>, PAUL FUJITANI <PFujitani@usbr.gov>, "Dibble, Chad@Wildlife" <Chad.Dibble@wildlife.ca.gov>, Maria Rea - NOAA Federal <maria.rea@noaa.gov>, Garwin Yip - NOAA Federal <garwin.yip@noaa.gov>, "Jen Norris" <jennifer_norris@fws.gov>, Kim <kim_s_turner@fws.gov>, Roger Guinee <roger_guinee@fws.gov>
Subject: Update to: FWS concurrence with proposed changes to Delta WQ standards, as requested by Reclamation and DWR

Board Chair Marcus,

Note: This email supersedes one I sent earlier today, which reflected a misunderstanding on my part. Apologies. Please discard the earlier email and substitute this one.

This email expresses the U.S. Fish and Wildlife Service's (Service) support for the State Water Board's proposal to implement the U.S. Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR) request to change the 40-30-30 Sacramento Valley water year type from "dry" to "critical," specifically as it pertains to relaxing the D-1641 water quality objectives for agricultural beneficial uses at four stations in the western Delta:

* Sacramento River at Emmaton, Station D-22;
* San Joaquin River at Jersey Point, Station D-15;
* South Fork Mokelumne River at Terminus, Station C-13; and
* San Joaquin River at San Andreas Landing, Station C-4.

The proposed change to the water year type for the specific water quality stations would reduce drawdown of Shasta Reservoir. This will likely benefit the early life history needs of the 2013 cohorts of Chinook salmon, in addition to providing higher carryover storage (than otherwise would be realized) to begin water year 2014.

The change in EC standard at these stations would occur immediately and last through August 15, 2013. The Service supports implementation of the proposal on a one-time basis, so long as implementation does not affect management of OMR flow to protect juvenile delta smelt in accordance with the Service's 2008 OCAP Biological Opinion.

It is our understanding that some discussions related to possible changes in Delta outflow have yet to occur. We will evaluate proposals related to deviations from the D-1641 Delta outflow standards when/if they are proposed.

The Service will continue to work cooperatively with its Federal and State partners to ensure that the CVP and SWP operations provide adequate protection for Threatened and Endangered species while delivering water that benefits 25 million agricultural and urban water users throughout California.

--

Mike Chotkowski
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650 Capitol Mall, Suite 8-300
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(916) 930-5632 Office
(916) 812-0155 Cell

BUREAU OF RECLAMATION
Central Valley Operation Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

DEPARTMENT OF WATER RESOURCES
Division of Operations and Maintenance
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

MAY 24 2013

IN REPLY REFER TO:
CVO-100
WTR-4.10

Thomas Howard
Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, California 95814

Subject: State Water Resources Control Board Water Right Decision 1641 Water Year Classification

Dear Mr. Howard:

The Department of Water Resources (DWR) and the United States Bureau of Reclamation (Reclamation) request that the State Water Resources Control Board (SWRCB) acknowledge that the water year classification for the Sacramento Valley based on the equation provided in Attachment 1, page 188 of Revised Water Rights Decision 1641 (D-1641) does not accurately reflect the unprecedented dry conditions experienced in 2013. Instead, the hydrologic conditions experienced between January and the present are characteristic of a "Critical" water year type. The current miscategorization in water year classification is projected to affect the storage of cold water pool for fisheries purposes due to controlling D-1641 Delta objectives in the May through August period. These objectives are:

1) EC parameters for Sacramento River at Emmaton (Interagency Station Number D-22), San Joaquin River at Jersey Point (Interagency Station Number D-15), South Fork Mokelumne River at Terminous (Interagency Station Number C-13), and San Joaquin River at San Andreas (interagency Station Number C-4) as defined in Table 2 on page 182
2) Delta Outflow, as defined on Table 3 on Page 184.

Water year classification also affects other objectives listed in D-1641 to a lesser degree, but it is not anticipated that those objectives will significantly control Delta operations in 2013.

Summary of Relevant Facts:

D-1641 imposes water quality objectives on the Central Valley Project (CVP) and State Water Project (SWP). Several of the objectives are dependent on the water year type as determined by the May 1, Sacramento Valley Index and the San Joaquin Valley Index. Although the January through April period during 2013 was the driest on record, the November and December precipitation was sufficient to result in a Sacramento Valley classification of "Dry" for water year 2013. The "Dry" water year classification is not representative of the extreme hydrological conditions in Northern California this calendar year and the water quality objectives based on this water year type could result in significant adverse impacts to the cold water pool operations at Shasta Reservoir. In fact, Governor Brown's recent executive order B-21-13 recognizes that, "much of California experienced record dry conditions in January through March 2013, registering historic lows on the Northern Sierra" and "record dry and warm conditions resulted in a snowpack substantially below average, with estimated May water content in the statewide snowpack being only 17 percent of average."

The 2013 water year has been particularly challenging with double the normal precipitation in November and December and historically low values from January into May. The current Northern Sierra 8 Station Precipitation Index from January 1, 2013 through May 15 is about 8.8 inches. Without additional measurable precipitation in May, this figure will represent the driest Northern Sierra 8-Station Precipitation Index for the January through May period on record. Attachment 1 shows the accumulated 8-station precipitation values from January through May for some of the extremely dry years including 1924, 1976, and 1977. The nearly 80 percent of this year's precipitation occurred in the first three months of the water year, and an abnormally large portion of this fell as rain rather than snow as a result of warmer than normal conditions for that time of year. This combined with critically dry conditions in the months since the first of the year has resulted in minimal snow pack in the Sierra Nevada in the critical spring months. The Northern Sierra snowpack was only about 48% of the historical April 1 value and about 17% of normal as of May 1, 2013. Creek and small stream flows that enter the Sacramento River system below major reservoirs are running at historically low levels in response to the extended dry period. DWR's May 1, 2013 Bulletin 120 forecasts an April to July runoff 48% of normal for the Sacramento Valley. Hydrological conditions are not likely to improve and the National Oceanic and Atmospheric Administration has indicated that California is in severe to extreme drought that is likely to persist or intensify into the summer (Attachment 2).

Additionally, unusually high depletions in the Sacramento Valley are adding to the operational challenges the CVP and SWP (collectively, Projects) are facing in meeting the 2013 water year type requirements. Typically, extremely dry years with low Northern Sierra 8-Station Precipitation Index values trigger the Shasta inflow shortage criteria included in water rights settlement contracts that would reduce water supplies for the senior water rights diverters in the Sacramento Valley. Yet, this year the wetter conditions in the fall months were sufficient to require full allocations to the Sacramento Valley and Feather River settlement contractors, increasing demands on Shasta and Oroville storage. Therefore, it is expected that depletions will continue to run at a high rate into the summer. DWR and Reclamation are required to make releases in order to satisfy the senior water rights of the Sacramento River and Feather River settlement contractors, and the Exchange Contractors. These contracts specify the amount of water the Projects must deliver – for the Sacramento River and Exchange Contractors, Reclamation is required to deliver 100% of the contract total in any year where the forecasted inflow to Shasta Reservoir exceeds 3.2 million acre feet (af). This target was met in 2013 – thus Reclamation is mandated to deliver 100% of the contract total, and has no discretion under the contract to reduce these deliveries.

The unusually high stream depletions (Attachment 3) were a major cause of the exceedence of the Emmaton objective that occurred in April and May. This is described in further detail in DWR and Reclamation's letter to SWRCB dated May 24, 2013. The CVP and SWP reservoir systems were in a near normal condition in January, but Reclamation and DWR have drawn heavily on the storage since then due to the extended dry period, low unregulated flow entering the system, and high depletions in the Central Valley. Reservoir releases are currently well above average for this date.

In order to meet the Dry year water quality objectives rather than the Critical objectives, DWR and Reclamation have released significant volumes of water from Oroville, Shasta, and Folsom Reservoirs. The low reservoir inflow and increased storage withdrawal is depleting the cold water pool in the reservoirs that is important to provide adequate instream fishery habitat for anadromous fish in the rivers through the summer and fall.

SWRCB Water Rights Order 90-05 requires that Reclamation operate Shasta Reservoir to meet a daily average temperature of 56 degrees Fahrenheit in the Sacramento River at a location and through periods when higher temperatures will be detrimental to the fishery. Typically, through coordination with the Sacramento River Temperature Task Group (SRTTG), the location selected is between Balls Ferry and Bend Bridge on the Sacramento River. Without recognition of the Sacramento Valley water year type actually experienced in 2013, the projected low reservoir storage and limited cold water pool this year may result in the objective occurring well upstream of Balls Ferry and Reclamation is concerned whether the 56 degree objective can be maintained at any location in the Sacramento River through the fall. The cold water pool is vital to providing adequate habitat to salmon present in the Sacramento River through the summer and into the fall for both the winter-run Chinook salmon and fall-run Chinook salmon. The SRTTG has recommended an initial temperature compliance point of Airport Road located upstream of Balls Ferry due to the limited cold water resources this year.

Due to the unprecedented hydrologic conditions discussed above including the record dry January through May period, extremely low snowpack, and unusually high Sacramento valley depletions, conditions continue to deteriorate and it is clear that meeting the dry year objectives could jeopardize the ability to meet other fisheries objectives later in the year. The reservoir storage that accumulated in the wet fall, which was originally projected to be sufficient to meet the dry year objectives, is falling rapidly due to the abnormally large valley demands and

Reclamation is projecting CVP September carryover storages only about 63% of average.

There is a significant difference between the volume of Delta inflow needed to achieve the Dry and Critical water quality objectives for Jersey Point and Emmation through June 15. If Reclamation and DWR are able to begin operating to the Critical year water quality objectives in May it may be possible to achieve 100,000 to 200,000 af, of cold water benefits in the upstream reservoirs. This savings in cold water storage would improve the chances of meeting the temperature objective at Airport Road. This cold water benefit will help avoid temperature related fish losses in the Sacramento River.

The greatest benefits to the Project's reservoir storage would occur in the May to August 15 period. The compliance locations in the Western Delta and Interior Delta shown in Table 3 on Page 182 (Sacramento River at Emmaton (Interagency Station Number D-22), San Joaquin River at Jersey Point (Interagency Station Number D-15), South Fork Mokelumne River at Terminous (Interagency Station Number C-13), and San Joaquin River at San Andreas Landing (Interagency Station Number C-4) would most likely be the objectives controlling the Project operations during the May to June 15 period and changes at these locations would have the greatest impact on improving upstream storage in the immediate future. The objectives of the Delta outflow compliance location in Table 3 on page 184 often can control Project operations through the summer and operating to a critical year with respect to Delta outflow will also assist in preserving cold water pool.

Currently, DWR and Reclamation are maintaining a Net Delta Outflow well over 9,000 cubic feet per second (cfs) in order to achieve the Dry year objectives for Jersey Point and Emmaton. If the Dry classification is changed to Critical, the controlling D-1641 objective through June would be the Net Delta Outflow Index of at least 7,100 cfs in Table 3, or the export to inflow ratio of 35% in Table 3. From July through August 15, the controlling criteria for either water year classification would most likely shift among the minimum Net Delta Outflow objectives in Table 3, the salinity objectives for Jersey Point and Emmaton in Table 2, the Export to Inflow ratio of 65% in Table 3, or the Contra Costa 250 chloride objective in Table 1.

Table 2 of D-1641 requires an electrical conductivity (EC) no greater than 0.45 mmhos/cm for both Emmaton and Jersey point locations from April 1 to June 15, and 1.67 mmhos/cm for Emmaton and 1.35 mmhos/cm for Jersey Point from June 15 to August 15 under a Dry Year classification. For a Critical year these objectives are 2.78 mmhos/cm from April 1 to August 15 for Jersey Point and Emmaton. Since the X2 outflow objective of 7,100 cfs, which is not linked to the year type designation would probably control in May, and June, there would only be a gradual increase in salinity at Jersey Point and Emmaton through June that is reflective of a Critical year. Water quality at Jersey Point and Emmaton would fluctuate with the tidal and meteorological conditions potentially moving towards a 1.0 to 2.0 mmhos/cm EC range in July. Compliance with the water quality objectives at the Jersey Point and Emmaton locations typically achieves the objectives at Terminous and San Andreas Landing. This gradual increase in salinity levels would be commensurate with those experienced in years with similar hydrologic conditions as those observed in recent months.

Reclamation estimates that from May through August 15 a change in the water year classification from Dry to Critical in the Western Delta and Interior Delta locations in Table 2 could result in a gain of about 115,000 af, in upstream reservoir carryover storage at the end of September. Including the Delta outflow compliance in Table 3 for the same period would increase the gain in reservoir carryover storage to about 185,000 af. There could be reductions in the release from Keswick Reservoir up to about 1,000 cubic feet second in late May and June under a Critical year classification.

D-1641 requires that the number of days less than or equal to 150 mg/l chloride at Contra Costa Pumping Plant be greater than 165 days for a Dry year and 155 days for a Critical year. DWR and Reclamation do not anticipate that this objective would be a controlling criteria for the Projects under either year classification and both objectives would be met. The minimum Net Delta Outflow required from February through June (Collinsville X2 at 7,100 cfs) should be adequate to achieve the Contra Costa objective under either the Dry or Critical classification.

SWRCB recognition of the change in water year type is in the public interest. The change will provide for a water year classification reflective of the extremely dry hydrologic conditions in 2013 and allow the projects to operate in a manner that will provide the maximum benefit to critical beneficial users without unreasonably affecting other designated beneficial uses. As noted above there will be no significant impacts to agricultural or municipal uses, and the change will provide significant benefit to fisheries resources. State and federal agencies have been focused on the protection and improvement of fishery conditions in the Delta watershed, and are in the process of analyzing options for balancing project operations for the numerous different beneficial uses. Approval of the following request would result in water quality conditions in the North Delta that are consistent with the hydrology we are currently experiencing, while preserving cold water storage critical to salmon survival.

Requested Action:

Reclamation and DWR request that the SWRCB recognize the change in year classification need and act immediately. Delaying such recognition to even June 1 will significantly impair Reclamation's ability to meet cold water temperature objectives on the Sacramento River. At present, the controlling D-1641 Delta water quality objectives for the Projects that are linked to the Sacramento Valley Index are Jersey Point in Table 2, Emmaton in Table 2. In addition, Delta Outflow in Table 3, may become a controlling standard and will also impact cold water pool storage starting in the middle of June.

We believe the SWRCB may balance protection of the beneficial uses in light of the critical water year type experienced on the Sacramento River in 2013. Immediate benefits to cold water pool storage can be achieved through the Projects meeting critical water year standards for the Interior and Western Delta salinity standards in Table 2. The compliance points at issue are Sacramento River at Emmaton (Interagency Station Number D-22), San Joaquin River at Jersey

Point (Interagency Station Number D-15), South Fork Mokelumne River at Terminous (Interagency Station Number C-13), and San Joaquin River at San Andreas Landing (Interagency Station Number C-4).

Additional cold water pool benefits can be achieved in July through September with recognition of the critical water year type in Table 3, Water Quality Objectives for Fish and Wildlife Beneficial Uses. As noted above; Delta outflow objectives will likely control project operations in July through September, where agricultural objectives are met under a critical water year designation. A Delta outflow standard reflective of the critical water year type may produce an additional 70,000 af of cold water pool storage.

If you have any questions or would like more information regarding this notification, please contact Mr. Paul Fujitani of Reclamation at 916-979-2197 or Mr. John Leahigh at 916-574-2722.

Sincerely,

Ronald Milligan

Ronald Milligan, Operations Manager
Central Valley Operations Office
U.S. Bureau of Reclamation

for D. Roose

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Attachment -4

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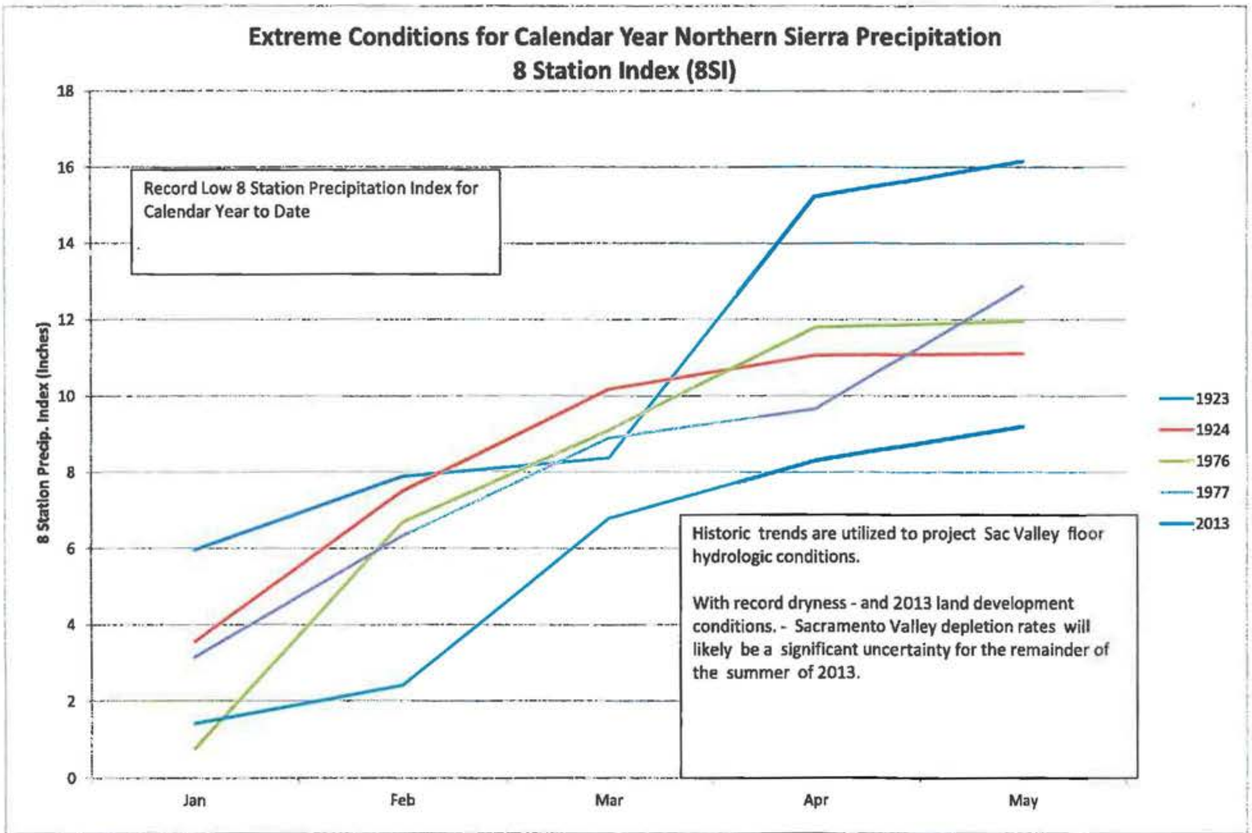
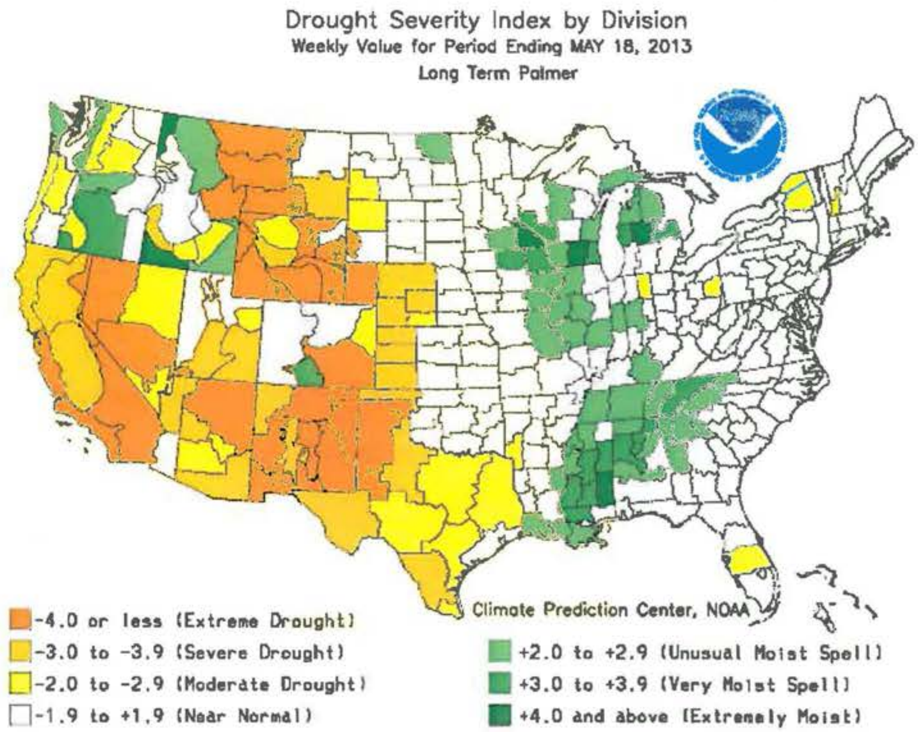
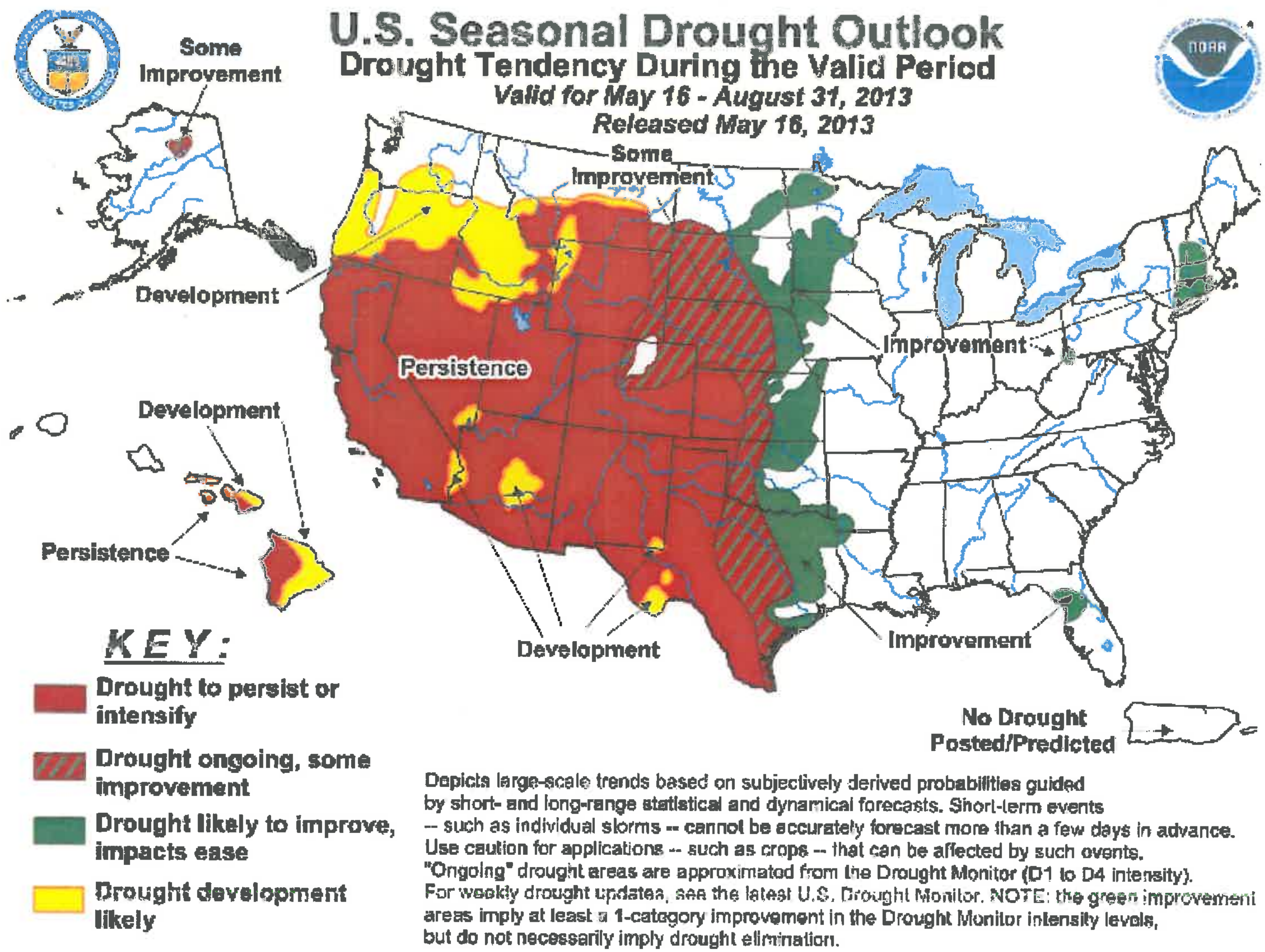
Attachment 1



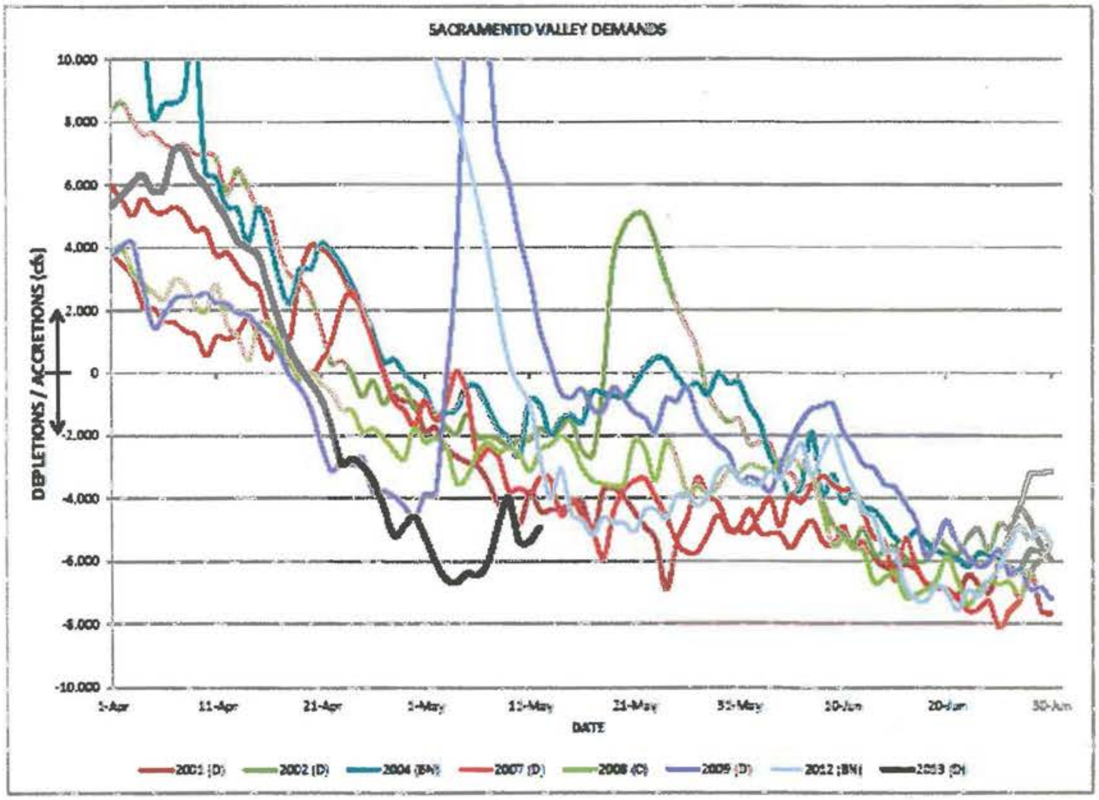
Attachment 2



Attachment 3



Attachment 4



NG01

November 25, 2014

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RE: Comments and Recommendations on U.S. Bureau of Reclamation and San Luis & Delta-Mendota Water Authority Draft Long-Term Water Transfer DRAFT EIS/EIR, dated September 2014

This letter provides comments and recommendations on the information provided in the September 2014 Draft Long-Term Water Transfer Environmental Impact Statement/ Environmental Impact Report (Draft EIS/EIR) prepared by the U.S. Bureau of Reclamation (BoR) and San Luis & Delta-Mendota Water Authority (SLDMWA). This document evaluates the potential impacts of alternatives over a 10-year period, 2015 through 2024, for transferring Central Valley Project (CVP) and non-CVP water from north of the Sacramento-San Joaquin Delta (Delta) to CVP contractors south of the Delta. These transfers require the use of CVP and State Water Project (SWP) facilities. This Draft EIS/EIR evaluated impacts of alternatives for water transfers made available through groundwater substitution, cropland idling, crop shifting, 1
reservoir release, and conservation.

This letter focuses mostly on the groundwater substitution element of the transfers for the Sacramento Valley groundwater basin and proves comments and recommendations regarding the potential impacts, technical information submitted, and monitoring and mitigation measures. Comments and recommendations are also provided regarding the biological resources, crop idling/crop shifting when those resources or activities impact or are impacted by the groundwater substitution transfers. This letter has two parts. The first part comments on the Draft Long-Term Water Transfer Draft EIS/EIR. The second part provides additional technical information on surface water–groundwater interactions that are relevant to the evaluation of potential impacts from the proposed water transfers, monitoring during the transfers and designing and implementing mitigation measures.

I. Comments and Recommendations on the Draft Long-Term Water Transfer DRAFT EIS/EIR

The Draft EIS/EIR evaluated a number of potential environmental impacts from the groundwater substitution transfers using a finite element groundwater model, SACFEM2013. The potential impacts evaluated include: groundwater levels; surface water flow; water quality; biological 2
resources, including vegetation, wildlife and fisheries; and the associated cumulative effects and impacts. Two mitigation measures, WS-1 and GW-1, are provided for monitoring and

mitigating potential impacts from groundwater substitution transfers. I will provide comments and recommendations on these topics following seven comments and recommendations on general issues, assumptions and methods that are used throughout the Draft EIS/EIR.

<u>General Comments</u>

1. The Draft EIS/EIR has an underlying assumption that specific information on each proposed transfer will be evaluated in the future by the Bureau of Reclamation, the California Department of Water Resources (DWR), perhaps the California State Water Resources Control Board (SWRCB), and local agencies, presumably the County, or other designated local agency (Sections 1.5, 3.1.4.1-WS-1 and 3.3.4.1-GW-1). The Draft EIS/EIR relies on the results of the SACFEM2013 groundwater modeling effort to validate the conclusion of less than significant and reasonable impacts that cause no injury from the groundwater substitution transfer pumping. This conclusion is reached based on model simulation results, and assumption of implementation of mitigation measures WS-1 and GW-1. However, the Draft EIS/EIR provides only limited information on the wells to be used in the groundwater substitution transfers (see Table 3.3-3), and no information on non-participating wells that may be impacted. Information that is still needed to evaluate the potential impacts simulated by the groundwater modeling and the potential significance of the groundwater substitution transfer pumping includes, but isn't limited to:

a. proposed transfer wells locations that are sufficiently accurate to allow for determination of distances between the wells and areas of potential impact, 2
b. the distances between the transfer wells and surface water features,
c. the number of non-participating wells in the vicinity of the transfer wells that may be impacted by the pumping,
d. the distance between the transfer wells and non-participant wells that may be impacted by the transfer pumping, including domestic, public water supply and agricultural wells,
e. the number of non-participating wells in the vicinity of the transfer wells that can be expected to be pumped to provide public water supply or irrigation water during the same period as the transfer pumping,
f. the amount of well interference anticipated at each of the non-participating domestic, public water supply and agricultural wells in the vicinity of transfer wells,
g. the aquifers that the non-participating wells in the vicinity of the transfer wells are drawing groundwater from,
h. groundwater level hydrographs near the non-participating and participating transfer wells, to document the pre-transfer trends and fluctuations in groundwater elevations in order to evaluate the current conditions and serve as a reference for monitoring impacts from transfer pumping,
i. the identity and locations of wells that will be used to monitor groundwater substitution transfer pumping impacts, the aquifers these wells are monitoring, frequency for taking and reporting measurements, and the types and methods for monitoring and reporting,
j. groundwater level decline thresholds at each monitoring well that require actions be taken to reduce or cease groundwater substitution transfer pumping to prevent impacts from excessive drawdown, including impacts to non-participating wells, surface water features, fisheries, vegetation and wildlife, other surface structures, and regional economics.

   This list addresses only the minimum of information needed about the groundwater wells and does not address other elements of the groundwater substitution transfer, which I will discuss under separate sections, including the WS-1 and GW-1 mitigation measures, the SACFEM2013 groundwater modeling effort, and stream depletion impacts.

I recommend the Draft EIS/EIR be revised to include the additional well information and monitoring requirements listed above. I recommend that mitigation measures WS-1 and GW-1 be revised to provide specific requirements for monitoring, thresholds of significance, and actions to be taken when the thresholds are exceeded. 2

2. The only maps provided by the Draft EIS/EIR that show the location of the groundwater substitution transfer wells, and the rivers and streams potentially impacted are the simulated drawdown Figures 3.3-26 to 3.3-31, which are at a scale of approximately 1 inch to 18 miles on letter size paper. These figures show clusters of wells and several rivers, creeks and canals. A few are labeled, but apparently not all of the streams and creeks evaluated for groundwater substitution impacts are shown. Figures 3.7-1 and 3.8-2 show the major rivers and reservoirs evaluated in the biological analyses, and Tables 3.7-2, 3.7-3, and 3.8-3 list up to 34 small rivers or creeks that were apparently evaluated for stream depletion using the SACFEM2013 groundwater model. Without river/stream/creek labels on the drawdown figures at a scale that allows for reasonable measurement and review, it is difficult to determine the anticipated drawdown at the 34 small rivers and creeks or other important habitat areas. 3

   The Fisheries Section 3.7, and Vegetation and Wildlife Section 3.8 provide discussions of the potential impacts from groundwater substitution transfer induced stream depletion (Sections 3.7.2.1.1, 3.8.2.1.1 and 3.8.2.1.4). The Well Acceptance Criteria of Table B-1 in Appendix B of the October 2013 joint DWR and BoR document titled *Draft Technical Information for Preparing Water Transfer Proposals* (DTIPWTP) lists in the table footnotes eight major and three minor surface water features tributary to the Delta that are affected by groundwater pumping. Apparently, the Well Acceptance Criteria in Table B-1 will be applied to these eleven surface water features as part of mitigation measure GW-1. Whether the Well Acceptance Criteria will also be applied to the creeks listed in Tables 3.7-2, 3,7-3 and 3.8-2 is not specifically stated in the Draft EIS/EIR or GW-1. 4

   The lack of maps with sufficient detail to see the relationship between the wells and the surface water features prevents adequate review of the Draft EIS/EIR analysis to determine whether mitigation measures WS-1 and GW-1 will be effective at mitigating pumping impacts. As I will discuss in Part 2 of this letter, the distance between a surface water feature and a pumping well is a critical parameter in estimating the rate and duration of stream depletion. Maps are needed of each seller's service area at a scale that allows for reasonably accurate measurement of distances between the groundwater substitution transfer wells and surface water features, other non-participating wells, proposed monitoring wells, fisheries, vegetation and wildlife areas, critical surface structures, and regional economic features. 5

   I recommend the Draft EIS/EIR be revised to provide additional maps of each seller's service area at a scale that allows for reasonably accurate measurement of distances between the groundwater substitution transfer wells and surface water features listed in Tables 3.7-2, 3.7-3, 3.8-3 and B-1 as well as other non-listed surface water dependent features such as wetlands and riparian areas, non-participating wells, the proposed monitoring wells, wildlife areas, critical surface structures, regional economic features, and other structures that might be impacted by groundwater substitution pumping. 6

3. The Draft EIS/EIR evaluated a number of potential environmental impacts from the groundwater substitution transfers using the finite element groundwater model SACFEM2013. The results of the modeling effort were used in the assessment of the 7

potential biological resource impacts from reductions in surface water flow caused by groundwater substitution transfer pumping (pages 3.7-18 to 3.7-30, and 3.8-49 to 3.8-67). The Draft EIS/EIR assumes that SACFEM2013 model results are sufficiently accurate to justify removing most of the small creeks from a detailed effects analysis (Table 3.7-3 and 3.8-3).

Statements are given that the mean monthly reduction in the Sacramento, Feather, Yuba and American rivers will be less than 10 percent (pages 3.7-25 and 3.8-49) and that other stream 7
requirements of flow magnitude, timing, temperature, and water quality would continue to be met. However, actual SACFEM2013 model results on anticipated changes in flow, temperature and water quality are not provided for all of the surface water features that may be potentially impacted by the groundwater substitution transfer projects. Creeks that passed a preliminary screening, Tables 3.7-3 and 3.7-4, were selected to be modeled by water year type for stream depletion that exceeds 1 cubic feet per second (cfs) and 10% reduction in mean monthly flow. Results of the modeling effort are presented in Tables 3.8-4 to 3.8-7.

The Draft EIS/EIR notes that not all surface water features were evaluated because some lacked sufficient historical flow data, or they were too small to model (page 3.7-20). The Draft EIS/EIR then assumes that the pumping impacts to un-modeled small surface water features are similar to nearby modeled features. No maps with sufficient detail are provided to allow for determination of the spatial relationship between the modeled and un-modeled surface water features, or the relationship between the groundwater substitution transfer 8
wells and the modeled and un-modeled surface water features (see comment no. 2). The distance between a well and a surface water feature is a critical parameter in determining the rate and timing of surface water depletion resulting from groundwater pumping. The validity of the assumption that the un-modeled surface water features will respond similarly to the modeled is dependent on the distance between them and their respective distances to the pumping transfer well(s). I will discuss in more detail in Part 2 the importance of distance in the calculation of stream depletion.

The Draft EIS/EIR also provides Figures B-5 and B-6 of Draft EIS/EIR Appendix B that graph in aggregate the changes in stream-aquifer interactions, presumably equal to changes in stream flow, based on the SACFEM2013 simulations. While these graphs are interesting for several reasons, they don't provide information specific to each seller service area on flow losses expected in each river and creek. No figures are provided that show the longitudinal- 9
or cross-sections of channel where impacts are expected, or the rate of stream depletion in each channel section. Maps with rates and times of stream depletion by longitudinal channel section are needed to allow for an adequate review of the Draft EIR/EIS conclusion of less than significant and reasonable impacts with no injury. These maps are also needed to evaluate the specific locations for monitoring potential impacts.

Statements are made in Section 3.7 that reductions in surface flow due to groundwater substitution pumping would be observed in monitoring wells in the region as required by mitigation measure GW-1. Thus detailed maps that show the locations of the monitoring wells and the areas of potential impact along with the rates and seasons of anticipated stream depletion are needed for each service area. These maps are also needed to allow 10
for evaluation of the cumulative effects whenever pumping by multiple sellers can impact the same resource. Without site-specific information on expected locations and changes in flow at each potentially impacted surface water feature, it's difficult to evaluate the adequacy of any monitoring effort.

I recommend the Draft EIS/EIR be revised to provide additional information on the anticipated changes in surface water flow, temperature, water quality and channel geomorphology for each river, creek and surface water feature in the areas of groundwater substitution transfer pumping. In addition, I recommend that maps showing the along channel longitudinal sections, the maximum anticipated changes in flow rate, water temperature, water quality, and the timing of the maximum anticipated rate of stream depletion due to groundwater substitution transfer pumping be provided at an appropriate scale to allow for adequate measurement and review in the Draft EIS/EIR, and for use in the WS-1 and GW-1mitigation monitoring programs. 11

4. The results of the SACFEM2013 simulation are used to evaluate stream depletion quantities and impacts for vegetation and wildlife resources that are dependent on surface water (Sections 3.7 and 3.8), and to determine the expected lowering of groundwater levels in the areas of transfer pumping (Section 3.3). The groundwater substitution transfer pumping simulation was run from water year (WY) 1970 to WY 2003 and assumed 12 periods of groundwater substitution transfer at various annual transfer volumes as shown in Figure 3.3-25. The apparent Draft EIS/EIR baseline for analysis of groundwater pumping impacts ends with WY 2003 because of limitations of the CalSim II surface water operations model. The CalSim II model was jointly developed by DWR and BoR and is used to determine available export capacity of the Delta. The WY 2003 time limitation was adopted in the SACFEM2013 groundwater-modeling effort apparently because of the desire to combine the simulation of groundwater impacts with estimating the timing of when groundwater substitution water could be transferred through the Delta (Section 3.3.2.1.1). The description of the SACFEM2013 modeling effort states that the volume of groundwater pumping was determined by "comparing the supply in the seller service area to the demand in the buyer service area" (page 3.3-60). 12

While this is an interesting modeling exercise, and much can be learned from it, the simulations didn't evaluate the impacts of pumping the maximum annual amount proposed for each of the 10 years of the project. It is important that with any simulation used to analyze potential project impacts that the maximum levels of stress, pumping, proposed by the project be simulated at each of the project locations for the entire duration of the project. This is especially important whenever the simulations are used to justify the conclusion that project impacts will be less than significant, reasonable and cause no injury. Because the groundwater modeling effort didn't include the most recent 11 years of record, it appears to have missed simulating the most recent periods of groundwater substitution transfer pumping and other groundwater impacting events, such as recent changes in groundwater elevations and groundwater storage (DWR, 2014b), and the reduced recharge due to the recent periods of drought. Without taking the hydrologic conditions during the recent 11 years into account, the results of the SACFEM2013 model simulation may not accurately depict the current conditions or predict the effects from the proposed groundwater substitution transfer pumping during the next 10 years. 13

Although the Draft EIS/EIR project description is specific on the volumes and periods of groundwater substitution transfer pumping as shown in Tables 2-4 and 2-5, the write-up of the groundwater modeling effort aggregated the volume pumped (Sections 3.3.2.4.2 and B.4.3.1.2 in Appendix B). The simulated volume of groundwater pumped doesn't reach the maximum being requested by the project in any individual year or for all ten years (Figures B-4 in Appendix B and 3.3-25). Note, the annual groundwater substitution transfer amounts shown in Figure B-4 in Appendix B are not the same as the amounts simulated by the SACFEM2013 model as shown in Figure 3.3-25. The presentation of the SACFEM2013 14 model results in Sections 3.3.2.4.2 and B.4.3.1.2 don't tabulate or provide detailed maps by seller service area on the pumping rates, cumulative pumped volumes, pumping times and 14 durations, or which aquifers were pumped in the simulations. The model documentation doesn't provide the maximum drawdown or the expected centers of maximum drawdown for each seller service area.

The documentation of the SACFEM2013 model results should also discuss the variations in potential impacts that might result from pumping transfer wells other than those simulated. If the groundwater simulation didn't pump all of the transfer wells listed in Table 3.3-3 for each seller at their maximum rate, then the modeling documentation should describe how the impacts from the simulation should be evaluated for the non-simulated transfer wells and for those well simulated at less than maximum pumping. For example, if the modeling effort provides the pumping time and distance drawdown characteristics of each well this 15 information can be used to estimate the drawdown at different distances, pumping rates, and durations of pumping (see pages 238 to 244 in Driscoll, 1986). The Draft EIS/EIR should provide the time-drawdown and distance-drawdown hydraulic characteristics for each groundwater substitution transfer well so that non-simulated impacts can be estimated. The Draft EIS/EIR should then describe a method(s) for estimating the drawdown at different distances, rates and durations of pumping so that non-participant well owners can estimate and evaluate the potential impacts to their well(s) from well interference due to the pumping of groundwater substitution transfer well(s).

Because the rate of stream depletion is scaled to pumping rate and because the model documentation doesn't indicate the pumping locations, rates, volumes, times or durations that produced the pumped volumes shown in Figure 3.3-25, or the stream depletions shown in Figures B-5 and B-6 in Appendix B, there is uncertainty whether the SACFEM2013 modeling simulated the maximum rate of stream depletion for the proposed 10-year 16 project. The annual volume of groundwater pumping shown in Figure 3.3-25 are less than the maximum requested, and pumping for a continuous 10 years was not simulated. This suggests that the stream-interaction values or stream depletion(?) shown in Figures B-5 and B-6 of Appendix B are not the maximum level of impact that might occur from the 10-year project.

Without information on the rate, timing and duration of the groundwater pumping, there can be no evaluation of whether the annual simulated impacts are representative of the two pumping seasons listed in Table 2-5, or just a single 3-month pumping season. Whenever the simulated annual pumping rate was greater than the single season maximum of 163,571 acre-feet (AF), two seasons of pumping are required, but the percentage in each season is unknown. If the simulated pumping time represents only one season or a mixture of the two seasons, then the simulation may not reflect the actual timing and/or duration of 17 maximum groundwater substitution pumping impacts proposed in Table 2-5. If a simulation doesn't evaluate the project under existing conditions or simulate the maximum stress allowed by the project description, then it raises a question of whether the Draft EIS/EIR adequately evaluated the projects potential impacts. Without thorough documentation of the SACFEM2013 groundwater impact simulation, it is difficult to review and analyze the model's predictions for potential impacts from each seller's groundwater substitution transfer project, or use the model results in designing and setting impact thresholds for the groundwater monitoring required in mitigation measure GW-1.

I recommend the Draft EIS/EIR be revised to provide a more complete description of the SACFEM2013 groundwater modeling effort, including 18 **tabulation of the groundwater substitution pumping rates, volumes, durations,**

and dates for each simulated well; the hydraulic characteristics of each well simulated; the aquifer(s) pumped by each simulation well; the impacts from the maximum proposed pumping, annually and during the 10-years of the proposed project; sufficiently detailed maps of the well locations in each seller's service area that non-participants and the public can use to identify any well's relationship to the groundwater substitution transfer wells and understand the potential impacts to groundwater levels. I recommend the Draft EIS/EIR 18 **provide, for each transfer well, the pumping time and distance drawdown characteristics such that drawdown for durations, distances and rates of pumping other than those simulated can be estimated. I recommend the Draft EIS/EIR also provide an explanation of why the simulation is representative of the current (2014) conditions, how the simulation can be used to assess current and future conditions, and how the simulation can be used to evaluate, monitor and set impact thresholds for future impacts from the 10-year project at the maximum groundwater substitution transfer pumping volumes listed in Tables 2-4 and 2-5.**

5. The Draft EIS/EIR was written from the perspective of the process of transferring surface waters through the Delta. This surface water point of view has carried over into some of the analyses of impacts and mitigations for groundwater pumping. For example, the discussions of potential impacts to surface water users, fisheries, and other stream dependent biological resources are thought of as occurring "downstream" of the groundwater substitution wells. While it is correct that groundwater pumping can impact down gradient resources, pumping can also affect up gradient and lateral resources. A pumped well creates a depression in the surrounding aquifer, often referred to as a "cone of depression." Thus, the area of impact around a pumping well is not a single point, but a region whose extent is sometimes called the "area, radius or zone of influence." The length 19 of stream affected by groundwater pumping is related to the distance between the well and the stream (Figures 16 and 29 from Barlow and Leake, 2012; Exhibits 1.1 and 1.2). Miller and Durnford (2005) noted that for an ideal aquifer and stream at longer durations of pumping, when the stream depletion rate approaches the well pumping rate, 50% the stream depletion occurs within a stream reach length of twice the distance between the stream and well, and 87% of the depletion occurs within a reach length of 10 times the stream to well distance. Obviously, for non-ideal aquifers and streams the length of stream depleted will vary from the ideal, but this illustrates that stream depletion caused by a pumping well is not focused at one point, but occurs along a length of stream with impacts that occur upstream and downstream from the point on the stream that is typically closest to the well.

   Because groundwater is generally flowing, the water table or piezometric surface has a slope. This slope causes the cone of depression around a pumping well to elongate along the direction of regional flow. The elongated cone of depression is often referred to as a "capture zone" (Frind and others, 2002) and determining its extent is a basic part of a pump and treat groundwater cleanup program (USEPA, 2008a). This "capture zone" is related to stream depletion capture because the pumping well intercepts groundwater that would 20 eventually discharge to surface water or be used by surface vegetation. If the "capture zone" extents far enough it may cross a surface water feature and induce greater seepage. However, unlike the capture needed for a contaminant plume, stream depletion can occur without the actual molecule of water that enters the well having to originate from the stream (Figure 29; Exhibit 1.2).

   The stream depletion occurs when groundwater is either intercepted before reaching the stream or seepage from the stream is increased. This water only has to backfill the change 21

in storage caused by pumping, it doesn't have to enter the well. The "capture zone" also extends upgradient to the recharge area that's the normal source of water flowing past the well. The aquifer recharge that flows past the pumping well may be derived from a wide mountain front area, it could be a section of another river that crosses the the "capture 21
zone", or an overlying area of agricultural irrigation. In a complex hydrogeologic setting, numerical modeling that utilize particle tracking is needed to define where a pumping well is recharged and where it may deplete surface water features (Frind and others, 2002; Franke and others, 1998).

The concepts of a wide zone of influence and an elongated "capture zone" are important for the Sacramento Valley groundwater substitution transfers projects because the analysis and monitoring of potential pumping impacts requires a multidirectional evaluation. It can't be assumed that stream depletion impacts from pumping occur only downstream from the point on the stream closest to the pumping well. Any monitoring of the effects of groundwater substitution pumping on surface or ground water levels, rates and areas of 22
stream depletion, fisheries, vegetation and wildlife impacts, and other critical structures needs to cover a much wider area than what is needed for a direct surface water diversion. This is a fundamental issue with the Draft EIS/EIR. The environmental analyses, monitoring requirements and mitigation measures appear to be developed without adequately considering the multidirectional, wide extent of potential impacts from groundwater substitution transfer pumping.

I recommend the Draft EIS/EIR be revised to address the wide extent of potential impacts for groundwater substitution transfer pumping. This should include conducting numerical modeling of the groundwater basin using particle tracking to determine which surface water features and other structures are 23
potentially impacted by the pumping of each transfer well and to determine the extent of stream depletion along each potentially impacted surface water feature. The monitoring and mitigation measures WS-1 and GW-1 should also be revised to account for a wide area of potential impact from groundwater substitution transfer pumping.

6. The Draft EIS/EIR is written with the assumption that project specific evaluation for each seller agency will be done at a later time by the BoR and/or DWR, and at the local level (see 24
Section 3.3.1.2.3, mitigation measure GW-1 in Section 3.3.4.1, and Section 3.1 in the DTIPWRP). The Draft EIS/EIR lists in Table 3.3-1 and Table 3-1 of the DTIPWRP the Groundwater Management Plans (GMP), agreements and county ordinances that regulate the sellers at a local level. The Draft EIS/EIR discusses only two county ordinances, the Colusa Ordinance No. 615 and Yolo Export Ordinance No. 1617, one agreement, the Water Forum Agreement in Sacramento County, and one conjunctive use program, the American River Basin Regional Conjunctive Use Program. The Table 3-1 in the DTIPWRP 25
lists short descriptions of the county ordinances related to groundwater transfers, if one exists. These descriptions don't always identify the actual ordinance number that applies to a groundwater substitution transfer, but sources for additional information are provided in the table.

The DTIPWRP (page 27) and GW-1 (page 3.3-88) instructs the entity participating in a groundwater substitution transfer that they are responsible for compliance with local groundwater management plans and ordinances. Except for the brief discussion of the two ordinances, one agreement, and one conjunctive use program listed above, the Draft EIS/EIR 26
doesn't describe the requirements of local GMPs, ordinances, and agreements listed in Tables 3.3-1 (page 3.3-8) and Table 3-1 (page 27). Thus, the actual groundwater substitution

transfer project permit requirements, restrictions, conditions, or exemptions required for each seller service area by BoR, DWR, and one or more County GMP or groundwater ordinance will apparently be determined at a future date. It follows that any actual monitoring requirements, mitigation measures, thresholds of significance required by BoR, 26
DWR or local governing agencies will also be determined at a future date. The mechanism for the public to participate in the determination of the actual groundwater substitution transfer project permit requirements, restrictions, conditions, mitigation measures or exemptions isn't specified in the Draft EIS/EIR.

Addition information is needed on what the local regulations require for exporting groundwater out of each seller's groundwater basin. The Draft EIS/EIR needs to discuss how the local regulations ensure that the project complies with California Water Code (WC) Sections 1220, 1745.10, 1810, 10750, 10753.7, 10920-10936, and 12924 (for more detailed discussion of these Water Codes see Draft EIS/EIR Section 3.3.1.2.2). Although the Draft EIS/EIR doesn't document, compare or evaluate the requirements of all local agencies that have authority over groundwater substitution transfers in each seller service area, the Draft EIS/EIR concludes that the environmental impacts from groundwater substitution transfer pumping by each of the sellers will either be less than significant and cause no injury, or be mitigated to less than significant through mitigation measures WS-1, and GW-1 with it's reliance on compliance with local regulations. Because the spatial limits of groundwater substitution pumping impacts are controlled by hydrogeology, hydrology, and rates, 27
durations and seasons of pumping, the impacts may not be limited to the boundaries of each seller's service area, GMPs, or County. There is a possibility that a seller's groundwater substitution area of impact will occur in multiple local jurisdictions, which should results in project requirements coming from multiple local as well as state and federal agencies. The Draft EIS/EIR doesn't discuss which of the multiple local agencies would be the lead agency, how an agreement between agencies would be reached, or how the requirements of the other agencies will be enforced. The Draft EIS/EIR only briefly mentions the Northern Sacramento Valley Integrated Regional Water Management Plan (IRWMP) (page 3.3-91 and -92) and doesn't mention the American River IRWMP (http://www.rwah2o.org/rwa/programs/irwmp/), the Yuba County IRWMP (http://yubairwmp.org/the-plan-irwmp/content/irwmp-plan), or the Yolo County IRWMP (http://www.yolowra.org/irwmp.html). The Draft EIR/EIS doesn't provide information on the water management requirements of the IRWMP covering each seller service area or how the groundwater substitution transfers will be accounted for in the IRWMP process.

Because the Draft EIS/EIR requires that each individual transfer project meet the requirements of Water Code sections listed above, and because it assumes that each of the sellers will separately comply with all federal, state and local regulation, GMPs, IRWMPs, ordinances or agreements, the Draft EIS/EIR should provide an analysis of how these local regulations, GMPs, ordinances or agreements will ensure each seller's project achieves the 28
goals of no injury, less than significant and reasonable impacts. Each seller's project analysis should identify what future analyses, ordinances, project conditions, exemptions, monitoring and mitigation measures are required to ensure that each of the seller's project meets or exceed the goals of the Draft EIS/EIR.

I recommend the Draft EIS/EIR be revised to include a discussion and comparison of the local regulations, GMPs, IRWMPs, ordinances and agreements that govern each of the seller's proposed groundwater substitution 29
transfers. I recommend each analysis demonstrate that each seller's project will meet or exceed the environmental protection goals of the Draft EIS/EIR. I recommend an analysis that compares local and regional management plans,

ordinances, regulations, and agreements with the monitoring and mitigation measures in the Draft EIS/EIR to identify any additional mitigation measures needed to ensure compliance with local, regional, state and federal regulations. 29
I recommend an analysis that includes: (1) a discussion on how the local lead agency will be determined; (2) how multiagency jurisdictions will be enforced; (3) how conflicts between different local, regional, state and federal regulatory jurisdictions will be resolved; and (4) how public participation will occur.

7. The Draft EIS/EIR provides only one groundwater elevation map of the Sacramento Valley groundwater basin, Figure 3.3-4, which shows contours from wells screened from a depth greater than 100 feet to less than 400 feet below ground surface (bgs) (>100 to < 400 feet bgs) and only for the northern portion of the proposed groundwater substitution transfer 30
seller area. The Draft EIS/EIR doesn't provide maps showing groundwater elevations, or depth to groundwater, for groundwater substitution transfer seller areas in Placer, Sutter, Yolo, Yuba, and Sacramento counties.

The DWR provides on a web site a number of additional groundwater level and depth to groundwater maps at: http://www.water.ca.gov/groundwater/data_and_monitoring/northern_region/GroundwaterLevel/gw_level_monitoring.cfm#Well%20Depth%20Summary%20Maps.

For example, there are maps that show the change in groundwater levels from the spring of 2004 to spring of 2014 for shallow screened wells (<200 feet bgs), intermediate wells (>200 to <600 feet bgs), deep wells (>600 feet bgs), and well screened in the >100 to < 400 feet bgs interval. In addition, the DWR web site has a series of well depth summary maps for 31
Butte, Colusa, Glenn, and Tehama counties, and the Redding Basin that show the density of wells screened at less than 150 feet bgs, and between 150 and 500 feet bgs, along with contours of the depth to groundwater in the summer of 2013. There are also numerous other groundwater elevation contour maps on DWR's web page, going back to 2006. Historical and recent groundwater elevation and depth contours maps for Placer, Sutter, Yolo, Yuba, and Sacramento counties may be available from the groundwater substitution transfer sellers, other water agencies in those counties, the IRWMP documents, or technical reports on groundwater management (for example, Northern California Water Association, 2014a, b, and c).

Historic change and current groundwater contour maps are critical to establishing an environmental baseline for the groundwater substitution transfers. This information is needed to evaluate the impacts from groundwater substitution transfers because it 32
establishes the present groundwater basin conditions and document the changes and trends in groundwater levels in the last 10-plus years, which were not simulated by the SACFEM2013 modeling.

Information on the depth to shallow groundwater is critically important because of the analysis of impacts to vegetation and wildlife in Section 3.8 assumed, based on the results of the SACFEM2013 model, that the current depth to shallow groundwater is greater than 15 feet bgs for most of the Sacramento Valley groundwater basin (page 3.8-32). Because the 33
simulation showed a condition of greater than 15 feet depth to groundwater, the Draft EIS/EIR concluded that impacts from lowering of the shallow water table as a result of the groundwater substitution transfer pumping would be less than significant (page 3.8-47).

This assumption however appears to conflict with the DWR shallow well depth summary maps (DWR, 2014a) that show contours of the depth to groundwater in wells less than 150 34
feet bgs in the summer 2013. These maps show extensive areas around the Sutter Buttes

and to the north were the depth to groundwater is less than 10 feet and 20 feet (Exhibit 2.1). These maps also show extensive areas where the depth to groundwater is less than 40 feet, a depth significant to some tree species such as the valley oak (page 3.8-32). There is also a recent trend of lower groundwater levels in a number of areas in the Sacramento Valley as shown on the DWR 2004 to 2014 groundwater change maps for shallow, intermediate, deep aquifer zones available from the web site listed above (DWR, 2014b). Exhibit 2.1 has a composite map of the shallow zone well depth maps and traces of the shallow zone 2004 to 2014 groundwater elevation change contours. 34

These groundwater elevation, depth and changes in elevation maps are important for documenting baseline groundwater conditions. The recent trend of decreased groundwater levels should be included in the analysis of groundwater substitution pumping impacts because the drawdowns shown in Figures 3.3-26 to 3.3-31 will interact with existing conditions, and may cause additional long-term decreases in groundwater levels. The Draft EIS/EIR's assessment of the impacts from groundwater substitution transfer pumping to existing and future wells, fisheries, vegetation and wildlife, and surface structures should factor in these recent trends in groundwater levels and not rely solely on SACFEM2013 model simulations that ended in 2003. In addition, the hydrographs in Appendix E that show the SACFEM2013 model results should identify wells near the selected 34-hydrograph locations where groundwater level measurements have been taken and show these actual groundwater levels on the hydrographs. Currently the public is left with the task of finding groundwater level data near the 34 selected hydrograph locations and then validating the simulation results by making comparisons between the simulated water levels and the actual water levels. This model validation task should be part of the Draft EIS/EIR. 35

I recommend the Draft EIS/EIR be revised to include maps of recent groundwater levels and depths to groundwater along with changes in groundwater levels and depths for at least the last 11 years for all of the counties where the seller agencies propose a groundwater substitution transfer project. I recommend that the Draft EIS/EIR be revised to provide additional verification of the SACFEM2013 model results by comparing them to measured groundwater levels in the vicinity of the 34 selected modeling hydrograph locations. I also recommend the hydrographs of actual water level measurements in the vicinity be included on the simulation hydrographs, so that the public can review the accuracy of the simulation. I recommend contour maps showing the current depth to groundwater be made from actual shallow groundwater measurements and that these contours be shown on maps of the surface water features identified and evaluated in Draft EIS/EIR Sections 3.3-Groundwater, 3.7-Fisheries (Table 3.7-3), and 3.8-Vegegation and Wildlife (Table 3.8-3). I recommend that the SACFEM2013 simulation drawdowns be combined with the current (2014) groundwater elevations for each groundwater substitution transfer aquifer to show the cumulative impacts of the 10-year project on existing groundwater elevations. 36

<u>Groundwater Model SACFEM2013</u>

A finite element groundwater model, SACFEM2013, was used to evaluate the potential for changes in groundwater levels and stream depletion from groundwater substitution transfer pumping during the 10-year period of the project. The results of the simulations were used to evaluate the impacts to fisheries, vegetation and wildlife (Section 3.7 and 3.8). Section 3.3.2.1 discusses the use of the model for estimating regional groundwater level declines due to groundwater substitution pumping. Figures 3.3-26 to 3.3-31 provide simulated changes in 37 groundwater elevation or head for three intervals, up to 35 feet bgs, 200 to 300 feet bgs, and 700 to 900 feet bgs. Figures 3.3-32 to 3.3-40 and Appendix E provide hydrographs of model simulations for 34 selected locations shown on the simulated groundwater elevation change maps. Sections 3.7.2.1.1, 3.7.2.1.3, 3.7.2.4.1, 3.8.2.1.1, 3.8.2.1.4, and 3.8.2.4.1 provide discussion on the potential impacts of groundwater substitution transfer pumping on fisheries, vegetation and wildlife resources from a drop in the shallow groundwater table and depletion of stream flows.

The SACFEM2013 model was set up to simulate transient flow conditions from WY 1970 to WY 2010 (page 3.3-60). Historic data from 1970 to 2003 were use to estimate the potential impacts from groundwater substitution transfers during the 10-year period of the project. The simulation terminated at 2003 because that was the last simulation period available for the CalSim II model, a planning model designed to simulate operations of the CVP and SWP reservoirs and water delivery systems. Additional SACFEM2013 model documentation is given in Appendix D, which provides information on the model gridding, layering, assumptions and calculation methods. Several of the model designs and parameters selected likely influenced the model's ability to predict future impacts from the 10-year
groundwater substitution transfer project. Those include: the time period of the model, the 37
assumptions about the amount and frequency of groundwater substitution pumping, the model's nodal spacing, estimates of aquifer properties, the number of streams simulated, streambed parameters, and specified-flux boundaries. There are at least two other groundwater simulation models developed for the Sacramento Valley, a U.S. Geological Survey model, USGS-CVHM (Faunt, ed., 2009) and a DWR-C2VSim model (Brush and others, 2013a and 2013b).

A comparison between the SACFEM2013 and these two other models provides an interesting assessment of how these three models estimated the hydrogeologic character and conditions of the Sacramento Valley. A comparison also demonstrates that there is no one correct groundwater model, that models with different parameter distributions can achieve reasonable calibration. With models of differing hydrogeologic characteristics, the predictions of future impacts by each model should be expected to differ. Determining which of the models accurately predicts future impacts requires the validation of each model's prediction with new field data. The Draft EIS/EIR mitigation measures for groundwater substitution transfer pumping shouldn't assume that the SACFEM2013 model results are all that is needed to demonstrate no injury and less than significant impacts from the proposed project. Validation of the model-based conclusion of no impacts requires collection of new field data and comparison to simulation predictions throughout and beyond the 10-year project.

A comparison of portions of the SACFEM2013 simulation for the Draft EIS/EIR with the two other models is given below.

8. *Period of Modeled Historic Groundwater Conditions* – Although the model simulation period ended in 2003, the Draft EIS/EIR indicates that the model was run to 2010, but the results were not provided. From the model write-up it is unknown whether the latest
groundwater elevations were a factor in the modeling effort. The simulation hydrographs in 38
Appendix E terminate in 2004. Apparently, the hydrologic conditions for the latest 10 years are not included because the Draft EIS/EIR doesn't discuss how the model simulations agree with the current baseline conditions. Specifically, the change in groundwater elevation between 2004 and 2014 as document by DWR (2014b) in a series of three maps. I've

provided in attached Exhibits 3.1 to 3.3 maps that are composites of DWR's 2004 to 2014 groundwater change maps with Draft EIS/EIR Figures 3.3-29, 3.3-30 and 3.3-31, the SACFEM2013 1990 hydrologic conditions simulations of drawdown by zone. The 1990 hydrologic condition was selected for comparison because the sequence of groundwater pumping events is the closest match to the actual pumping requested in the Draft EIS/EIR. Note that the depth intervals of the two sets of maps don't exactly coincide, but they are generally grouped as shallow, intermediate and deep aquifers.

Exhibits 3.1 to 3.3 show that the simulated changes in groundwater elevation from the 10-year groundwater substitution transfer project appear to widen the existing groundwater depressions. The pumping depression southwest of Orland will expands to the east and northeast, as will the depression in the Williams area. A pumping depression will develop in the Live Oaks area and to the east. In the southeastern Sacramento area, the pumping depression from the 10-year project will apparently extent southeastward beyond the limits of the Sacramento Valley transfer project boundary. Combining the existing areas of recent 38
sustained groundwater drawdown with the additional drawdown from the groundwater substitution transfer pumping could slow the recovery of groundwater elevations. The 10-year project pumping east of Orland may connect the two existing groundwater depressions around Orland and Chico to create one large depression. Because the DWR 2004 to 2014 groundwater change maps don't extend completely to the southern portions of the Sacramento Valley groundwater substitution transfer area in Placer, Sutter, Yolo, Yuba, and Sacramento counties, no evaluation can be made about the impact of 10 years of groundwater substitution transfer pumping on existing groundwater conditions in those or adjacent areas.

I recommended the Draft EIS/EIR be revised to discuss how the SACFEM2013 simulations incorporate the changes in groundwater level from 2004 to 2014 in assessing the potential impacts from the proposed 10 years of groundwater substitution transfer pumping. I recommended this discussion include evaluation of the rate and duration of groundwater level recovery that factors in the existing (2014) groundwater levels. I also recommend the Draft EIS/EIR be revised to discuss how during the 10 years of project transfers through the Delta will be made with a CalSim II model that's only current to the year 2003.

9. *Simulation Pumping Volume and Frequency* - The model simulated a series of groundwater pumping events in 12 out of the 34 years of simulation (page 3.3-60). The logic of a multiyear, variable hydrology simulation was that it allowed for evaluation of the cumulative effects of pumping in previous years (page 3.3-61). Figure 3.3-25 shows the simulated periods of groundwater substitution transfer pumping. The 1990 simulation period most closely matches the multiyear pumping being requested by the 10-year project. The 1990 simulation period included groundwater pumping 7 out of 10 years, with pumping values ranging from approximately 95,000 acre-feet per year (AFY) to approximately 262,000 AFY, as measured from Figure 3.3-35. Note the actual pumping rates, volumes, and pumping 39
durations were not provided in the simulation documentation. Apparently, none of the modeled groundwater substitution pumping simulation periods was given the actual maximum groundwater substitution pumping value of 290,495 AFY as calculated from Table 2-5. The time-weighted annual average pumping rate for the 1990 simulation period is approximately 126,900 AF, as measured from Figure 3.3-35. This represents approximately 44% of the maximum pumping rate requested in the Draft EIS/EIR (126,900 AF/290,495 AF = 0.437). Therefore the SACFEM2013 Draft EIS/EIR simulations may only represent a portion of the project's potential impacts from groundwater substitution transfer pumping.

I recommend the Draft EIS/EIR be revised to discuss how the SACFEM2013 simulations provide a full and accurate estimation of the potential impacts from the groundwater substitution transfer pumping throughout the 10-year project. 39 **I also recommend the Draft EIS/EIR be revised to include SACFEM2013 simulations at the maximum requested annual volume of 290,495 AF for each of the 10 years of pumping.**

10. *Simulation Grid Size* - The SACFEM2013 documentation states that the grid used for groundwater substitution transfer simulations has 153,812 nodes and 306,813 elements (page D-3 of Appendix D). The model nodal spacing varies from 410 feet to 3,000 feet, with an approximate nodal spacing of 1,640 feet along streams and flood bypasses. While this nodal spacing is reasonable for regional groundwater simulations, the results of the simulations may not provide the detail needed to evaluate drawdown interference between the groundwater substitution transfer wells and adjacent non-participating wells. Information is needed on the locations of the groundwater substitution transfer wells and the adjacent non-participating wells in order to determine whether the current simulation grid spacing can accurately estimate well interference. The Draft EIS/EIR analysis of groundwater substitution pumping impacts should be based on an appropriate model grid spacing to establish accurate maximum thresholds for well interference caused by the transfer well pumping. The Draft EIS/EIR should provide sufficient information that an owner of a non-participating well can determine accurately the maximum anticipated increase in drawdown at their well during the 10 years of groundwater substitution transfer pumping. Whether this amount of increased drawdown is significant at each non- 40 participating well is a matter of the current well design and groundwater conditions at each well. The Draft EIS/EIR should establish values for the maximum allowable well interference drawdown from groundwater substitution transfer pumping, which should be based on the costs and inconvenience of lowering the water level. The Draft EIS/EIR should establish the economic costs and level of injury that are reasonable for a non-participating well owner to assume and will keep the impacts from the 10-year project in compliance with the no injury rule as required by WC Section 1706, 1725 and 1736 (Section 1.3.2.3).

    I recommend the Draft EIS/EIR be revised to discuss how the maximum thresholds for water level drawdown due to well interference from groundwater substitution transfer pumping will be established for non-participating wells, and provide a process for assigning a threshold to each non-participating well, along with monitoring requirements and specific mitigation measures should the threshold be exceeded. The Draft EIS/EIR also should be revised to provide the threshold values for well system repair costs used in set the maximum allowable well interference drawdown, along with the documentation and analysis of why the well interference drawdown and cost thresholds are considered reasonable and result in no injury to non-participating well owners, and comply with the Water Code.

11. *Simulation Hydrogeologic Parameter Values* - The SACFEM2013 model was developed with seven layers of varying thickness that extend from the shallow water table to the base of fresh water. The USGS-CVHM model has ten layers, while the DWR-C2VSim model has 3 layers. All of the models assume that the uppermost layer, layer 1, was unconfined and the lower layers are confined aquifer. The hydrogeologic parameters values differ for each of 41 these models as shown in a summary table in Exhibit 4.1. Both the CVHM and C2VSim models divided the Central Valley in to 21 subregions (Figure 3, Brush and others, 2013a; Exhibit 4.4). The SACFEM2013 doesn't use subregions from the Sacramento Valley model. As discussed below, the SACFEM2013 appears to use the same distribution of the

horizontal hydraulic conductivity, Kh, for all model layers (Figure D-4 of Appendix D). Both the CVHM and the C2VSim models appear to have more varied hydraulic conductivity distributions then SACFEM2013.

Development of the SACFEM2013 simulations used horizontal hydraulic conductivity values derived from the well logs of large-diameter irrigation wells. Shallow and low-yielding wells, less than 100 gallons per minute (gpm), and domestic-type wells were not used (page D-12 of Appendix D). The values of specific capacity (gallons per minute per foot of drawdown) from the DWR well completion reports were used to estimate transmissivity around a well using an empirical equation for confined aquifer developed from Jacob's modified non-equilibrium equation (see equation 8 page D-13 and Appendix 16D of Driscoll, 1986 in Exhibit 4.6). Transmissivity was converted to Kh by assuming the aquifer thickness was equal to the length of the well screen interval. These well Kh values were then averaged using a geometric mean with surrounding wells within a critical distance of 6 miles. The results of the geometric mean averaging were then gridded using a kriging to produce Kh values across the modeled area (Figure D-4 in Appendix D). The transmissivity of each model layer was then calculated at each node by multiplying the kriged geometric mean value of Kh by the aquifer layer thickness. The vertical hydraulic conductivity, Kv, was calculated by assuming a uniform Kh:Kv ratio of 50:1 for layer 1 and 500:1 for layers 2 to 7.

The CVHM model (Faunt, ed., 2009) used the percentage of coarse-grained material from well logs and boreholes as the primary variable in a sediment texture analysis of the Central Valley, which was divided into nine textural provinces and domains (Figures A10 to A14; 41
Exhibits 4.7a to 4.7i). The Sacramento Valley has three textural domains, Redding, eastern, and western Sacramento domains (page 30, Faunt, ed., 2009). The coarse-grained fraction was correlated to horizontal (Kh) and vertical (Kv) conductivity (page 154, Faunt, ed., 2009). The Kh values were estimated using kriging and a weighted arithmetic mean, a type of power mean, whereas the Kv value estimates used either a harmonic or geometric mean. Faunt (ed., 2009) notes that the arithmetic mean is most influenced by the coarser-grained material, whereas the fine-grained material more heavily weights both the harmonic and geometric means. Figure C14 (Exhibit 4.7j) shows the relationship between the percentage of coarse-grained deposits and hydraulic conductivity for the different types of means. For the Sacramento Valley the texture-weighted power-mean value was -0.5, a value midway between the harmonic and geometric means (Table C8, Exhibit 4.3).

Table C8 lists the end member hydraulic conductivity values used in the CVHM model with those for the Sacramento Valley ranging from 670 feet/day (ft/day) for coarse-grained to 0.075 ft/day for fine-grained. The table also lists field and laboratory values of Kh and Kv for coarse and fine-grained deposits. The Redding textural domain has the highest percentage of coarse-grained material of the three in Sacramento Valley, a mean of 39 percent, with the western portion becoming coarser with depth (page 30, Faunt, ed., 2009). The western and eastern Sacramento domains are finer-grained, with the eastern mean at 32 percent coarse-grained deposits, and the western mean at 25 percent. Figure A15B(A?) (Exhibit 4.7k) shows the cumulative distribution of kriged sediment textures for each layer of the CVHM model for the Sacramento Valley. Figures A12A to A12E (Exhibits 4.7c to 4.7g) show the distribution of coarse-grained deposits in CVHM groundwater model layers 1, 3, Corcoran Clay, 6 and 9 for the Sacramento and San Joaquin Valleys. Isolated coarser-grained deposits that occur in layer 1 are associated with the Sacramento River, distal parts of fans from the Cascade Range and northern Sierra Nevada, and the American River (page 30, Faunt, ed., 2009; Figure A14, Exhibit 4.7i). Although the texture maps, Figures A12A to A12E of CVHM, and the hydraulic conductivity distribution map of Figure D4 of SACFEM2013, show different characteristic of each model's hydraulic conductivity, they can be compared by their visual complexity. The CVHM texture also varies by model layer, whereas the SACFEM2013 apparently applied the same Kh distribution to each layer. The CVHM western and eastern Sacramento domains appear to have smaller coarse-grained areas than the SACFEM2013 higher hydraulic conductivity areas (Figures A12, C14 and A15 in Exhibits 4.7c, 4.7j, and 4.7k versus D4 in Appendix D). Figure 12E (Exhibit 4.7g) shows layer 9 with high percentages of coarse-grained deposits that have higher Kh values (Figure C14) in the western parts of the Redding (10) and northern western portion of the western Sacramento (11) province. Whereas Figure D4 of SACFEM2013 shows these same areas as having the lowest Kh values, suggesting finer-grained textures dominate.

The C2Vsim model divided the Sacramento Valley into seven subregions, as did the USGS-CVHM model. Like the USGS model, hydraulic conductivity varies with the three model layers for the Sacramento Valley. The spatial variability of the Kh and Kv values for the C2VSim model is greater than with the SACFEM2013 model (compare Figures 34 and 35 41
from Brush and others, 2013a in Exhibits 4.8a to 4.8f to Figures D4 of Appendix D). Table 5 of Brush and others, 2013a (Exhibit 4.2) shows the range of model parameters for the saturated groundwater portion of the C2VSim model. Kh values range from 2.2 ft/day to 100 ft/day, and Kv from 0.005 ft/day to 0.299 ft/day. The highest Kh value for the C2VSim model is less than for SACFEM2013 (100 ft/day vs 450 ft/day), while the lowest values are lower (0.005 ft/day vs <0.1 ft/day).

I recommend the Draft EIS/EIR discuss the uncertainty in aquifer hydraulic parameter estimations for the groundwater substitution transfer pumping simulations and the sensitivity of the model results to the uncertainty in the groundwater hydraulic parameters. I recommend the Draft EIS/EIR discuss how the uncertainty in hydraulic conductivity parameters influences: (1) estimates of potential stream depletion (Section 3.3), (2) evaluations of fisheries impacts (Section 3.7), (3) evaluations of vegetation and wildlife impacts (Section 3.8), and (4) the screening procedures that removed a number of the small streams from further environmental impact analysis (Table 3.7-3 and 3.8-3).

12. *Simulation Groundwater Storage Parameters* - The SACFEM2013 simulations assigned to the upper unconfined model layer 1 a uniform specific yield (Sy) value of 0.12 (dimensionless) (page D-14 in Appendix D; Exhibit 4.1). For the confined model layers 2 to 7 a uniform specific storage, Ss, value of 6.5 x 10^{-5} per foot (ft) was used (page D-14 of Appendix D; Exhibit 4.1). Both the CVHM and C2VSim simulations used a range of values of Sy and Ss that were more variable than SACFEM2013 (Exhibits 4.1, 4.8n, and 4.8o). The CVHM simulation used a range of Sy and Ss values, (CVHM Table C8, Exhibits 4.3). The CVHM simulation also used a range of Ss values for coarse-grain elastic and fine-grained elastic and inelastic deposits to simulating subsidence from groundwater pumping. The C2VSim simulations used a range of Sy values for model layer 1 and separate ranges of Ss values for layers 2 and 3 (C2VSim Table 5, Exhibits 4.2; Exhibits 4.8g to 4.8i). The C2VSim and CVHM 42
models assigned a range of coefficients for elastic (Sce) and inelastic (Sci) deposits used in simulating subsidence (Exhibits 4.1, 4.8j to 4.8m). Note, the Ss values are multiplied by the aquifer thickness at each model node at to obtain the dimensionless value of storativity (S) for confined aquifers (S = Ss x thickness), which is similar to the dimensionless Sy parameter for an unconfined aquifer.

I recommend the Draft EIS/EIR discuss the uncertainty in aquifer storage parameter estimations for the groundwater substitution transfer pumping simulations and the sensitivity of the model results to the uncertainty in the groundwater storage parameters. I recommend the Draft EIS/EIR discuss how

uncertainty in groundwater storage parameters influences: (1) estimates of potential stream depletion (Section 3.3), (2) evaluations of fisheries impacts 42 **(Section 3.7), (3) evaluations of vegetation and wildlife impacts (Section 3.8), and (4) the screening procedures that removed a number of the small streams from further environmental impact analysis (Table 3.7-3 and 3.8-3).**

13. *Simulation River and Stream Parameters* - All three models simulated the interactions between the groundwater and streams or rivers. The rate and direction of movement of water between streams and shallow groundwater is governed by the vertical hydraulic conductivity of the streambed, Kvb, thickness of the streambed, m, the wetted perimeter of the stream, w, and the difference in elevation between groundwater table and stream. The hydraulic parameters of a streambed are combined into a term called conductance, C, which is calculated as the product of Kvb times the wetted perimeter divided by the streambed thickness (C = [Kvb x w]/m).

    The SACFEM2013 simulations assigned all eastern streambeds draining from the Sierra Nevada a Kvb value of 6.56 ft/day (2 meters/day), except the Bear River and Big Chico Creek, whose values were unstated (page D-7 of Appendix D). For all western streambeds draining the Coast Ranges, a higher value of Kvb at or above 16.4 ft/day (5 meters/day) was assigned. Figure 3.3-24 in the Draft EIS/EIR shows the SACFEM2013 groundwater boundary and the simulated rivers and streams. This map may not be showing all of the small streams evaluated in the simulation based on the streams listed in Tables 3.7-3 and 3.8-3 (also see 43 general comment no. 2).

    The streambed Kvb values used in CVHM simulation are shown in Figure C26 (Exhibit 5.3). The values of Kvb for the Sacramento Valley varying from approximately 0.04 ft/day to 5.6 ft/day are shown in Figure C26. Results of the CVHM simulation of surface water-groundwater interactions, gains and losses, from 1961 to 1977 are compared to measured and simulated stream gauge values in Figures C19A and C19B (Exhibits 5.4a and 5.4b).

    The C2VSim simulations also used varying values for streambed Kvb ranging from 0 to 44 ft/day with a mean of 1.8 ft/day and lake bed Kvb of 0.67 ft/day (page 100, Brush and others, 2013a; Exhibit 5.1). Simulated streambed conductance values are shown in Figure 40 of Brush and others, 2013a (Exhibit 5.2).

    I recommend the Draft EIS/EIR discuss the uncertainty in streambed parameter estimations for the groundwater substitution transfer pumping simulations and the sensitivity of the model results to the uncertainty in the hydraulic characteristics of the streambeds. I recommend the Draft EIS/EIR discuss how uncertainty in the hydraulic characteristics of the streambeds influences: (1) estimates of potential stream depletion (Section 3.3), (2) evaluations of fisheries impacts (Section 3.7), (3) evaluations of vegetation and wildlife impacts (Section 3.8), and (4) the screening procedures that removed a number of the small streams from further environmental impact analysis (Table 3.7-3 and 3.8-3).

14. *Groundwater Flow Between Sub-regions* - Of the three previously discussed regional groundwater models for the Sacramento Valley, only the reports for the C2VSim simulation provided information on the volume of groundwater that flows laterally among groundwater subregions. The C2VSim simulation results show that groundwater flow between 44 subregions has changed significantly in some areas (Figures 81A to 81C of Brush and others, 2013a and Figure 39 of Brush and others, 2013b; Exhibits 6.1a to 6.1c and 6.2). The SACFEM2013 simulations results presented in the Draft EIS/EIR don't provide information on the exchange between subregion areas used in simulations by the USGS (Faunt, ed.,

2009) and DWR (Brush and others, 2013a and 2013b). Therefore, the flow of groundwater between the subregions and/or counties of the 10-year project's groundwater substitution transfer sellers wasn't evaluated for potential impacts on neighboring areas. The loss or gain of groundwater from neighboring subregions should be evaluated in the Draft EIS/EIR.

Accounting for subsurface flow among subregions is an important part of the water balance because it is measures of the amount of impact that groundwater pumping in one subregion has on it's neighboring subregions. The subsurface inter-basin movement of groundwater is an important element in the analysis of the environmental impacts from the 10-year groundwater substitution transfer projects because the groundwater substitution transfer pumping by sellers in one region can have a significant impact on the groundwater levels, storage and stream depletion in adjacent regions.

The C2VSim simulations calculated the volume of groundwater that flowed between the subregions and presented the results for three decades, 1922-1929, 1960-1969, and 2000-2009, and for the total simulation period, 1922-2009. Tables 10 through 13 (Brush and others, 2014a; Exhibits 6.3a to d) provide the sum of inter-region groundwater flow for each model subregion, but not the individual values of flow among adjoining subregions. Figures 81 and 39 (Exhibits 6.1a to 6.1c and 6.2) give the simulated annual volume of inter-region flow for the three decades and from 1922 to 2009. An estimate of a portion of the long-term changes in groundwater storage in each subregion can be made by comparing the change in annual volume and flow direction between sub-regions.

For example, in the 1922 to 1929 simulation period subregion 9 (Sacramento-San Joaquin Delta received 81,000 AFY of groundwater flow from adjoining subregions 6, 8, 10 and 11 44
(Exhibit 6.1a). By 1969 the simulation shows that subregion 9 was still receiving a small volume, 2,000 AFY, of groundwater flow from subregion 6, but losing approximately 56,000 AFY to subregions 8, 10, and 11 (Exhibit 6.1b). A change in groundwater storage from 1929 to 1969 in the Delta of 135,000 AFY; from a plus 81,000 AFY to a minus 54,000 AFY. For 2002-2009, the simulation shows that the Delta still receiving a small volume, 4,000 AFY, of groundwater flow from subregion 6, but now losing 137,000 AFY to subregions 8, 10 and 11 (Exhibit 6.1c). A loss in storage in the Delta of 214,000 AFY from 1929. The 2000-2009 simulation period shows that subregion 8 is receiving a large portion of the groundwater flow out of the Delta, 112,000 AFY, a reversal in groundwater flow direction and a cumulative annual loss to the Delta from 1922-1929 of 147,000 AFY. Subregion 8 in turn loses 17,000 AFY of groundwater flow to subregion 7 in 2000-2009, and receives 123,000 AFY from subregion 11 (Exhibit 6.1c). A reversal of 1922-1929 when subregion 8 received 1,000 AFY from subregions 7 and gave 1,000 AFY to subregion 11.

The 10-year transfer project proposes under the groundwater substitution to pump up to approximately 75,000 AFY from subregions 7 and 8, Table 2-5. This additional pumping will likely cause additional groundwater to flow from the subregion 9, the Delta, and subregion 11 into subregion 8, and eventually to subregion 7. Similar shifts in direction and annual volumes of groundwater flow have occurred with the other Central Valley subregions. The changes direction and volume of flow between the Delta and surrounding subregions appear to be the largest shift in groundwater flow for in Sacramento Valley area.

I recommend the Draft EIS/EIR be revised to evaluate the subsurface flows between subregions in Sacramento Valley due to the proposed groundwater substitution transfer pumping. I recommend the Draft EIS/EIR be revised to include groundwater model simulations that account for the rates, volumes, times, and changes in direction of groundwater flow between the seller pumping areas and the surrounding non-participating regions. I recommend the Draft

EIS/EIR also analysis the short- and long-term impacts from the changes in 44
subregional groundwater flow caused by the 10-year transfer project.

<u>Mitigation Measure WS-1</u>

15. The purpose of mitigation measure WS-1 as stated in Draft EIS/EIR Section 3.1.4.1 is to mitigate potential impacts to CVP and SWP water supplies from stream depletion caused by groundwater substitution transfer pumping. The stream depletion factor (BoR-SDF) is imposed by the BoR and DWR because they *will not move transfer water if doing so violates the no injury rule* (page 3.1-21). The no injury rule is discussed in Section 1.3.2.3 and cites CA WC Sections 1725, 1736 and 1706. The language from WC 1736 that also requires transfers to not result in unreasonable effects to fish, wildlife, or other instream beneficial uses is discussed in the subsequent Section 1.3.2.4.

    Draft EIS/EIR Sections 3.1.2.4.1 (page 3.1-15) and 3.1.6.1 (page 3.1-21) discuss the impacts from groundwater substitution transfers on surface water. On page 3.1-16 the Draft EIS/EIR states that groundwater recharge, presumably greater because of groundwater substitution
    pumping, occurring during higher flows would decrease flow in surface waterways. During 45
    periods of high flow, the decrease in surface flow won't affect water supplies or the ability to meet flow or quality standards. The document also states that if groundwater recharge occurs during dry periods, presumably occurring when groundwater substitution transfers are needed, groundwater recharge would decrease flows and affect BoR and DWR operations. BoR and DWR would then need to either decrease Delta exports or release additional flows from surface storage to meet the required standards. These statements are followed by seemly conflicting statements that:

    > *Transfers would not affect whether the water flow and quality standards are met, however, the actions taken by Reclamation and DWR to meet these standards because of instream flow reductions due to the groundwater recharge could affect CVP and SWP water supplies.* (page 3.1-16)

    > *Increased releases from storage would vacate storage that could be filled during wet periods, but would affect water supplies in subsequent years if the storage is not refilled.* (page 3.1-17)

    The potential for the reduction in surface water storage to eventually cause reductions in streamflow and water quality isn't clearly addressed in the Draft EIS/EIR.

    > *Overall, the increased supplies delivered from water transfers would be greater than the decrease in supply because of streamflow depletion; however, the impacts from streamflow depletion may affect water users that are not parties to water transfers. On average, the losses due to groundwater and surface water interaction would result in approximately 15,800 AF of water annually compared to the No Action/No Project Alternative, or approximately a loss of 0.3 percent of the supply.* (page 3.1-18)

    > *In a period of multiple dry years (such as 1987-1992), the streamflow depletion causes a 2.8* 46
    > *percent reduction in CVP and SWP supplies, or 71,200 AF.* (page 3.1-18)

    > *To reduce these effects, Mitigation Measure WS-1 includes a streamflow depletion factor to be incorporated into transfers to account for the potential water supply impacts to the CVP and SWP. Mitigation Measure WS-1 would reduce the impacts to less than significant.* (page 3.1-18)

    Additional information on the requirements of WS-1 appears to be contained in the October 2013 joint DWR and BoR document titled *Draft Technical Information for Preparing Water Transfer Proposals* (DTIPWTP) because the discussion in that document's Section 3.4.3

on estimating the effects of transfer operations on streamflow says that a default BoR-SDF of 12 percent will be applied *"unless available monitoring data analyzed by Project Agencies supports the need for the development of a transfer proposal site-specific SDF"* (page 33). The document also states that: 46

> *Although real time streamflow depletion due to groundwater substitution pumping for water transfers cannot be directly measured, impacts on streamflow due to groundwater pumping can be modeled. Project Agencies have applied the results from prior modeling efforts to evaluate potential groundwater transfers in the Sacramento Valley to establish an estimated average streamflow depletion factor (SDF) for transfers requiring the use of Project Facilities.*

I have several comments on this analysis of stream depletion impacts and mitigation measure WS-1:

a. Sections 2.3.2.2 and 2.3.2.3 discuss potential groundwater substitution and crop idling transfers and the limitations on the timing of the transfers. Transfers typically occur from July to September, but could also occur from April to June if conditions in the Delta allow for transfer. Surface water to be used in groundwater substitution and crop idling transfers would be stored during April to June if the condition of the Delta is unacceptable for transfer.

   My understanding of the BoR-SDF in mitigation measure WS-1 is that at the same time transfer surface waters are flowing towards the Delta, a portion of that water is assigned to the waterway to "offset" or compensate for stream depletion caused by groundwater substitution pumping. The Draft EIS/EIR doesn't seem to address the issue of how to compensate for groundwater substitution pumping impacts occurring before or after the transfer water flows to the Delta, the long-term 47
   losses caused by the pumping in subsequent years, and cumulative impacts from multiple years of pumping by all sellers. Yet the Draft EIS/EIR acknowledges that stream depletion is cumulative and a cumulative increase in depletion can be significantly greater than with a single event (Section 4.3.1.2 in Appendix B). The SACFEM2013 simulation shows that stream depletion will continue for a number of years after the groundwater substitution pumping event (Figures B-4, B-5 and B-6 in Draft EIS/EIR Appendix B). Mitigation measure WS-1 doesn't appear to fully address how mitigation will occur for stream depletion impacts from groundwater substitution pumping during entire duration of the impact.

   I recommend mitigation measure WS-1 be revised to clearly address how reductions in stream flows caused by groundwater substitution transfer pumping will be mitigated to less than significant for all of the times when stream depletion is occurring, including the time before and after the water is physically transferred; long-term impacts; and cumulative impacts from multiple sellers over multiple years of participating in groundwater substitution transfers.

b. Although mitigation measure WS-1 doesn't state that its implementation is linked to the October 2013 DTIPWTP (that linkage is part of mitigation measure GW-1), the DTIPWTP discusses the use of the BoR-SDF in the methodology for determining the amount of water available for groundwater substitution transfer, 48
   and the effects of the groundwater substitution pumping on streamflow in Section 3.4 (page 31). Item 5 on page 31 gives the formula for using four steps in determining the amount of transferable water, one of which is subtraction of the

estimated streamflow reduction. Section 3.4.3 states on page 33 of the DTIPWTP that:

> *Although real time streamflow depletion due to groundwater substitution pumping for water transfers cannot be directly measured, impacts on streamflow due to groundwater pumping can be modeled. Project Agencies have applied the results from prior modeling efforts to evaluate potential groundwater transfers in the Sacramento Valley to establish an estimated average streamflow depletion factor (SDF) for transfers requiring the use of Project Facilities.*
>
> *Project Agencies will apply a 12 percent SDF for each project meeting the criteria contained in this chapter unless available monitoring data analyzed by Project Agencies supports the need for the development of a transfer proposal site-specific SDF.*
>
> *Project Agencies are developing tools to more accurately evaluate the impacts of groundwater substitution transfers on streamflow. These tools may be implemented in the near future and may include a site-specific analysis that could be applied to each transfer proposal.*

Mitigation measure WS-1 states on page 3.1-21 that:

> *The exact percentage of the streamflow depletion factor will be assessed and* 48
> *determined on a regular basis by Reclamation and DWR, in consultation with buyers and sellers, based on the best technical information available at that time. The percentage will be determined based on hydrologic conditions, groundwater and surface water modeling, monitoring information, and past transfer data.*

From these statements it appears that: (1) the BoR, DWR and other Project Agencies have previously analyzed the amount of stream depletion caused by past groundwater substitution transfers, and (2) the default of 12% BoR-SDF may not be applied to groundwater substitution during the 10 years of transfers because transfer-specific studies will be needed. The Draft EIS/EIR doesn't provide information or cite references on the previous modeling and/or monitoring efforts to determine the correct stream depletion factor. It also doesn't provide specific information on the method(s) and review process to be used in implementing mitigation measure WS-1, or what additional assessments are needed to determine the "exact percentage" for the BoR-SDF. Mitigation measure WS-1 appears to require that the assessment, the calculation methodology, and determination of the correct BoR-SDF be done at a future time. The Draft EIS/EIR doesn't state whether other regulatory agencies and/or the public will have an opportunity in the future to review and comment on the methodology and determination of the "exact percentage" of the BoR-SDF for each groundwater substitution transfer seller. The Draft EIS/EIR also doesn't state whether other regulatory agencies and/or public comments will be considered by BoR and DWR in determining the BoR-SDF percentage.

The statement that real time stream depletion can't be directly measured contradicts other statements in the Draft EIS/EIR, requirements of mitigation measure GW-1, and the scientific literature. For example: Section 3.5 of the DTIPWTP states that one of the objectives of the monitoring plan is to: 49

> *Determine the extent of surface water-groundwater interaction in the areas where groundwater is pumped for the transfer.* (page 34)

This objective is in the project's monitoring program therefore it appears to indicate that some method is available for monitoring the surface water-groundwater interactions, not just the pre-pumping model simulations. The Fisheries (3.7) and Vegetation Wildlife (3.8) sections of the Draft EIS/EIR appear to state that flow reductions in surface waterways caused by groundwater substitution pumping will be monitored. Paragraphs similar to the ones given below state that monitoring wells are part of the mitigation measure for surface waters: 49

> *In addition, flow reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Therefore, the impacts to fisheries resources would be less than significant in these streams.* (pages 3.7-26 and 3.7-56) 50

> *In addition, the Proposed Action has the potential to cause flow reductions of greater than ten percent on other small creeks where no data are available on existing streamflows to be able to determine this. The impacts of groundwater substitution on flows in small streams and associated water ways would be mitigated by implementation of Mitigation Measure GW-1 (see Section 3.3, Groundwater Resources) because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Implementation of these measures would reduce significant effects on vegetation and wildlife resources associated with streams to less than significant.* (pages 3.8-51, 3.8-58 and 3.8-68)

All of these statements seem to contradict the statement in mitigation measure WS-1 that stream depletion can't be measured in real time. Although the Draft EIS/EIR doesn't provide the technical method(s) for determining surface water flow using monitoring in groundwater wells, it's reliance on mitigation measure GW-1 to ensure that streamflows are adequate implies that a method is available. Because WS-1 and GW-1 both have one of the same objectives, to mitigation streamflow losses due to groundwater substitution pumping, the mitigation measure are linked. Thus, the real time monitoring of groundwater intended to mitigate streamflow losses under GW-1 might also facilitate real time monitoring of streamflow needed for WS-1. I'll provide in Part 2 of this letter some additional discussion and references to scientific literature on studies and methods for measuring stream seepage and stream depletion caused by groundwater pumping. 51

I recommend the Draft EIS/EIR be revised to clearly discuss the methods available for determining the value of the BoR-SDF for each groundwater substitution transfer well. I recommend the Draft EIS/EIR be revised to discuss the procedure for Project Agency review and approval, along with process for review and comment by other public agencies and the public. I recommend the Draft EIS/EIR be revised to discuss the methods and results of prior BoR-SDF determinations. I recommend the Draft EIS/EIR be revised to define the data needed to

determine the "exact percentage" of stream depletion from groundwater substitution pumping during the 10-year transfer project, the technical method(s) that will be used to calculate the amount of stream depletion and the BoR-SDF, and the method(s) for monitoring surface water flow losses and verifying the effectiveness of the BoR-SDF and mitigation measure WS-1. 51

c. Section 3.4.1 of the DTIPWTP discusses calculation of baseline groundwater pumping for groundwater substitution transfers. Baseline groundwater pumping and stream depletion reduction are part of the four-step process for determining the amount of transferable water (page 31). Water transfer sellers wanting to use groundwater substitution pumping are requested to submit information to:

> *Identify all wells that discharge to the contiguous surface water delivery system within which a well is proposed for use in the transfer program,* and

> *The amount of groundwater pumped monthly during 2013 for each well that discharges to the contiguous surface water delivery system.*

Section 3.4.2 discusses measuring groundwater pumping provided for groundwater substitution transfers and states that:

> *Sellers should provide pumping records from all wells that discharge to a contiguous surface water delivery system used in groundwater substitution transfers.* (page 32)

The requirement that the groundwater transfer pumping baseline and metering of transfer pumping be conditioned on the water being discharged to the *contiguous surface water delivery system* suggests that if the groundwater substitution pumping discharges to a non-contiguous surface water or directly to a field that the establishment of a pre-transfer pumping baseline and transfer metering aren't required. Is that the case? If it is the case, then how is the amount of transferable water determined whenever the groundwater substitution transfer pumping doesn't discharge to a *contiguous surface water deliver system?* If the pre-transfer baseline pumping is removed from the calculation, does that increase or decrease the amount of transferable water and how does that change the BoR-SDF requirement? Is metering required for groundwater substitution transfer wells that don't discharge to a *contiguous surface streams water delivery system?* If not, how will measurement of transferred water and the required amount of the BoR-SDF be verified? All of these factors are relevant because they are linked to mitigation measure WS-1 through the DTIPWTP four-step process to determine the amount of transferrable water. The amount of transferrable water incorporates the BoR-SDF to prevent injury and reduce groundwater substitution pumping stream depletion impacts to less than significant. 52

I recommend the Draft EIS/EIR be revised to provide a discussion of how the baseline for pre-transfer groundwater pumping will be determined and how metering of all groundwater substitution transfer pumping for wells will be done regardless of whether the well discharges to a contiguous surface water delivery system. I recommend the Draft EIS/EIR be revised to discuss how the BoR-SDF will be determined, monitored, and it's effectiveness verified for all groundwater substitution transfer wells regardless of whether the well discharges to a contiguous surface water delivery system.

Mitigation Measure GW-1

16. The Draft EIS/EIR has only two mitigation measures that apply to the groundwater substitution transfers, WS-1 and GW-1. GW-1 is the principle mitigation measure for the 10-year transfer project's Draft EIS/EIR and is discussed in Section 3.3.4.1. The requirements contained in the October 2013 joint DWR and BoR *Draft Technical Information for Preparing Water Transfer Proposals* (DTIPWTP) and its 2014 Addendum are included in GW-1 by reference. The monitoring and mitigation measures of GW-1 are generally statements of objectives and requirements for development in the future monitoring and mitigation plans that are approved by BoR and perhaps DWR. GW-1 doesn't appear to provide any future opportunity for review and comment by parties that may be impacted by the groundwater substitution transfers such as the non-participating well owners, the public, or other regulatory agencies. GW-1 has statements such as:

    The monitoring program will incorporate a sufficient number of monitoring wells to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place. (page 3.3-88)

    The monitoring program will include a plan to coordinate the collection and organization of monitoring data, and communication with the well operators and other decision makers. (page 3.3-89)

    Potential sellers will also be required to complete and implement a mitigation plan. (page 3.3-89)

    To ensure that mitigation plans will be feasible, effective, and tailored to local conditions, the plan must include the following elements: (page 3.3-90 and 3.3-91) 53

    - *A procedure for the seller to receive reports of purported environmental or effects to non-transferring parties;*
    - *A procedure for investigating any reported effect;*
    - *Development of mitigation options, in cooperation with the affected parties, for legitimate significant effects*
    - *Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs.*

    Reclamation will verify that sellers adopt and implement these measures to minimize the potential for adverse effects related to groundwater extraction. (page 3.3-91)

    GW-1 does have some specifics on requirements for the frequency of groundwater level monitoring, such as weekly monitoring during the transfer period (page 3.3-89). Requirements for the frequency of reporting are less specific. Summary tables to BoR during and after transfer-related groundwater pumping, and a summary report sometime after the post-project reporting period. The project reporting period extends through March of the year following the transfer (page 3.3-90). The requirement for only a single year of groundwater monitoring appears to be insufficient given the duration of the simulated pumping impacts (see Figure B-5 in Appendix B). Other reporting requirements such as groundwater elevation contour maps are given as "should be included" rather than "shall be included" (page 3.3-90).

    The BoR should already have monitoring and mitigation plans and evaluation reports based on the requirements of the DTIPWTP for past groundwater substitution transfers, which likely were undertaken by some of the same sellers as the proposed 10-year transfer project. The Draft EIS/EIR should provide these existing BoR approved monitoring programs and mitigation plans as examples of what level of technical specificity is required to meet the objectives of GW-1 that include: *(1) mitigate adverse environmental effects that occur; (2) minimize potential effects to other legal users of water; (3) provide a process for review and response to reported effects; and (4) assure that a local mitigation strategy is in place prior to the groundwater transfer* (page 3.3-91). In addition, examples of periodic reporting tables and final evaluation reports should be provided to demonstrate the effectiveness of the GW-1 process at preventing or mitigating impacts from the groundwater substitution transfer pumping. Other deficiencies in GW-1 have been discussed above in my comments nos. 1, 2, 3, 5, 6 and 15, and below in comment no. 18.

I recommend the Draft EIS/EIR be revised to include specifics on additional requirements that must be part of mitigation measure GW-1 including: (1) required distances from wells and surface water features, and aquifer zones for groundwater elevation monitoring; (2) the duration of the required post-transfer monitoring that accounts for the effects of the 10 years of pumping; (3) specifics requirements on scale and detail for maps, figures and tables needed to document groundwater substitution pumping impacts; and (4) specific threshold for changes in groundwater elevation, groundwater quality and subsidence that will be considered significant. I recommend the Draft EIR/EIS be revised to provide existing BoR approved monitoring and mitigation plans and reports for past groundwater substitution transfers as examples of the types of technical information necessary to ensure no injury with less than significant impacts and appropriate mitigations. I recommend the Draft EIS/EIR be revised to provide specifics on how the public will be able to participate in the BoR and DWR approval and revision process for the 10-year transfer project monitoring and mitigation plans. I also recommend the Draft EIS/EIR revise GW-1 to include the issues discussed elsewhere in my comments nos. 1, 2, 3, 5, 6, 15 and 18. 53

Water Quality

17. The Draft EIS/EIR discusses water quality in Section 3.2, but focuses on potential impacts to surface waters. Discussions of impacts from groundwater substitution transfer pumping on groundwater quality are given in Section 3.3 (pages 3.3-33 to 3.3-35). The Draft EIS/EIR discusses the potential for impacts to groundwater quality from migration of contaminants as a result of groundwater substitution pumping, but provides only a general description of the current condition of groundwater quality. Section 3.3 gives the following statements on water quality:

> *Groundwater Quality: Changes in groundwater levels and the potential change in groundwater flow directions could cause a change in groundwater quality through a number of mechanisms. One mechanism is the potential mobilization of areas of poorer quality water, drawn down from shallow zones, or drawn up into previously unaffected areas. Changes in groundwater gradients and flow directions could also cause (and speed) the lateral migration of poorer quality water.* (pages 3.3-59 and 3.3-60) 54
>
> *Degradation in groundwater quality such that it would exceed regulatory standards or would substantially impair reasonably anticipated beneficial uses of groundwater; or* (page 3.3-61)
>
> *Additional pumping is not expected to be in locations or at rates that would cause substantial long-term changes in groundwater levels that would cause changes to groundwater quality. Consequently, changes to groundwater quality due to increased pumping would be less than significant in the Redding Area Groundwater Basin.* (page 3.3-66)

*Inducing the movement or migration of reduced quality water into previously unaffected areas through groundwater pumping is not likely to be a concern unless groundwater levels and/or flow patterns are substantially altered for a long period of time. Groundwater extraction under the Proposed Action would be limited to short-term withdrawals during the irrigation season. Consequently, effects from the migration of reduced groundwater quality would be less than significant. (*page 3.3-83*)*

Groundwater extracted could be of reduced quality relative to the surface water supply deliveries the seller districts normally receive; however, groundwater quality in the area is normally adequate for agricultural purposes. Distribution of groundwater for municipal supply is subject to groundwater quality monitoring and quality limits prior to distribution to customers. Therefore, potential impacts to the distribution of groundwater would be minimal and this impact would be less than significant. (page 3.3-84)

The Draft EIS/EIR notes that several groundwater quality programs are active in the seller regions (pages 3.3-6 to 3.3-10). No maps are provided that show the baseline groundwater quality and known areas of poor or contaminated groundwater. Groundwater quality information on the Sacramento Valley area is available from existing reports by the USGS (1984, 2008b, 2010, and 2011) and Northern California Water Association (NCWA, 2014c). The Draft EIS/EIR doesn't compare the known groundwater quality problem areas with the SACFEM2013 simulated drawdowns to demonstrate that the proposed projects won't draw in or expand the areas of known poor water quality. The Draft EIS/EIR analysis doesn't appear to consider the impacts to the quality of water from private wells. Pumping done as part of the groundwater substitution transfer may cause water quality impacts from geochemical changes resulting from a lowering the water table below historic elevations, which exposes aquifer material to different oxidation/reduction potentials and can alter the mixing ratio of different quality aquifer zones being pumped. Changes in groundwater level can also alter the direction and/or rate of movement of contaminated groundwater plumes both horizontally and vertically, which may expose non-participating wells to contaminants they would not otherwise encounter. 54

As noted above in my general comment no. 7, the DWR well depth summary maps for the northern Sacramento Valley show that there are potentially thousands of private well owners in and adjacent to the proposed project areas of the groundwater substitution drawdown. Exhibit 2.1 has a composite map of DWR's northern Sacramento Valley well depth summary maps (DWR, 2014a) for the shallow aquifer zone, wells less than 150 feet deep and the areas of groundwater decline from 2004 to 2014 (DWR, 2014b). Exhibit 7.1 has a table that summarizes the range of the number of shallow wells by county that lie within the areas of groundwater decline from 2004 to 2014. In my general comment no. 5, I discussed the concept of capture zones for wells and the need for groundwater modeling using particle tracking to identify the areas where a well receives recharge. Particle tracking to define a well capture zone(s) can also be used to determine if known zones or areas of poor or contaminated water will migrate as a result of the groundwater substitution transfer pumping. Particle tracking can also identify private and municipal wells that lie within the capture zone of a groundwater substitution transfer well and might experience a reduction in water quality from the transfer pumping. Particle tracking can identify locations where mitigation monitoring of groundwater quality should be conducted to quantify changes in groundwater quality. 55

Even though there are already a number of shallow wells impacted by historic groundwater level declines, the Draft EIS/EIR reaches the conclusion that the groundwater substitution transfer pumping will not cause injury or a significant impact to groundwater quality. This 56 conclusion is reached in part because the assumed beneficial use of groundwater substitution pumped water is agricultural, or urban, where the quality of water delivered is monitored by an urban water agency. Only these two beneficial uses are assumed even though Table 3.2-2 lists numerous other uses for waters in the seller service areas. The Draft EIS/EIR doesn't provide sufficient information on existing water quality conditions in the Sacramento Valley to allow for evaluation of potential geochemical changes that groundwater substitution pumping might cause. The Draft EIS/EIR sets a standard of significance in degradation of groundwater quality that requires contaminants exceed regulatory standards or impair reasonably anticipated beneficial uses (page 3.3-61). This standard of significance ignores the regulatory requirements of the Water Quality Control Basin Plans (Basin Plans) (http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/index.shtml). The Draft EIS/EIR only briefly discusses the role of the Basin Plans in maintaining water quality (page 3.2-7). In addition this water quality threshold of significance likely violates the State Water Resources Control Board Resolution No. 68-16, titled *Statement of Policy with Respect to Maintaining High Quality of Waters in California*, that states:

> *"Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies became effective, such existing high quality will be maintained until it has been demonstrated to the state that any change will be consistent with the maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies."*

> *"The nondegradation policy of the State Board (Resolution No. 68-16) applies to surface and groundwaters that are currently better quality than the quality established in 'adopted policies.' In terms of water quality objectives, the basin plans are the source of adopted policies."* 56

I recommend the Draft EIS/EIR be revised to document the known condition of the groundwater quality in the Sacramento Valley and Redding Basin and include available maps. I recommend that this assessment evaluate the potential impacts from migration of known areas of poor groundwater quality that could be further impaired or spread as a result of the groundwater substitution transfer pumping. I recommend a groundwater quality mitigation measure be provided for evaluation the existing water quality in wells (assuming owner cooperation) within and adjacent to known areas of poor groundwater quality that lie within and adjacent to the simulated groundwater transfer drawdown areas, especially those that lie within the capture zone. I recommend the groundwater quality mitigation measure include: (1) procedures for sampling wells, (2) methods of water quality analysis, (3) a QA/QC program, (4) standards and threshold for water quality impairment consistent with public health requirements and Basin Plan beneficial uses and SWRCB Resolution No. 68-16, (5) provisions for independent oversight and review by regulatory agencies and affected well owners, and (6) specific reporting and notification requirements that keep the owners of non-participating wells, the public, and regulatory agencies informed. I recommend the groundwater quality mitigation measure include provisions for modification and/or treatment of non-participating wells should the quality of water delivered be significantly altered by groundwater substitution transfers. I recommend the groundwater quality mitigation measure be in effect during the 10-year period of transfer pumping and the following recovery period until groundwater flows return to the pre-project condition. I recommend the Draft EIS/EIR also

require a funding mechanism for implementing the groundwater quality mitigation measures for the entire 10-year duration of the groundwater substitution transfers and the recovery period. I recommend the costs of the 56 **groundwater quality mitigation monitoring be the responsibility of the project proponents, not the non-participating wells owners or the public. These costs should include reimbursement of any costs incurred by regulatory agency oversight and costs incurred by non-participating well owners.**

<u>Subsidence</u>

18. The impacts of subsidence due to groundwater substitution transfer pumping are discussed in Section 3.3. Section 3.3.1.3.2 discusses groundwater-related land subsidence and notes that Global Positioning System (GPS) surveying is conducted by DWR every three years at 339 elevation survey monuments throughout the northern Sacramento Valley (page 3.3-28). In addition, eleven extensometers, as shown in Figure 3.3-11, monitor land subsidence. Figure 3.3-11 provides graphs of the subsidence for five of the eleven extensometers; no information is provided on the results on the GPS surveys. Mitigation measure GW-1 also incorporates by reference the October 2013 DTIPWRP and its 2014 Addendum. The 57 DTIPWRP doesn't add any additional monitoring or mitigation requirements for subsidence, stating that areas that are susceptible to land subsidence may require land surface elevation surveys, and that the Project Agencies will work with the water transfer proponent to develop a mutually agreed upon subsidence monitoring program (pages 34 and 37). Apparently the Draft EIS/EIR expects that the mutually agreed upon subsidence monitoring programs will be a future mitigation measure. The Draft EIS/EIR doesn't discuss how other regulatory agencies or the public will participate in the reviewing and commenting on any future subsidence mitigation measure.

    The Draft EIS/EIR relies on local GMPs and county ordinances to prevent impacts from subsidence, but doesn't discuss any specific monitoring or mitigation measures for each proposed groundwater substitution transfer pumping area (page 3.3-7). The Draft EIS/EIR acknowledges that subsidence has occurred in the past in portions of the Sacramento Valley in Yolo County (page 3.3-29), and that the Redding groundwater basin has never been 58 monitored (page 3.3-17). Yet only a qualitative assessment of potential project impacts was done by comparing SACFEM2013 simulated groundwater drawdowns with areas of existing subsidence and by comparing estimates of pre-consolidated heads/historic low heads (page 3.3-61).

    The Draft EIS/EIR relies on the mitigation measure GW-1 to prevent and remedy any significant impacts from subsidence. The requirements in mitigation measure GW-1 for subsidence impacts specify that the BoR will determine, apparently in the future and only when mutually agreed upon, the "strategic" monitoring locations throughout the transfer area where land surface elevations will be measured at the beginning and end of each transfer year (page 3.3-89). When the land surface elevation survey indicates an elevation decrease in an area, more subsidence monitoring will be required, which could include: (1) extensometer monitoring, (2) continuous GPS monitoring, or (3) extensive land-elevation 59 benchmark surveys conducted by a licensed surveyor. More extensive monitoring will be required for areas of documented historic or higher susceptibility to land subsidence (page 3.3-89). The Draft EIS/EIR concludes that with these subsidence monitoring mitigation measures of GW-1, impacts will be reduced to less than significant (page 3.3-66).

    Exhibits 8.1a to 8.1c provides composite maps using as a base DWR's *Spring 2004 to 2014 Change in Groundwater Elevations* (DWR, 2014b) for the shallow (less than 200 feet bgs), intermediate (200 to 600 feet bgs) and the deep (greater than 600 feet bgs) aquifer zones in the northern Sacramento Valley. A map of the natural gas pipelines in the Sacramento Valley (Exhibit 8.6) has been scaled and combined with Exhibits 8.1a to 8.1c. Exhibit 8.2 depicts on DWR's (2014b) intermediate zone change in groundwater elevation map, the locations of extensometers and the GPS subsidence grid (from Figure 6 in DWR, 2008; Exhibit 8.4), and the known subsidence area southeast of Williams and into Yolo County (from Draft EIS/EIR Figure 3.3-11)).

The subsidence area in Yolo County isn't fully shown on the DWR's 2014 groundwater 59 elevation change maps, but is shown in the composite maps (Exhibits 8.1a to 8.1c). These exhibits and Exhibit 8.2 show that the western line of extensometers lies along the eastern edge of the intermediate zone of greatest groundwater elevation change, and aligns with the central axis of the mapped changes in groundwater elevation in deeper aquifer zone. The extensometers don't appear to lie within the area of known subsidence southeast of Williams and into Yolo County (Figure 3.3-11). The GPS subsidence grid network does extend across eastern portion of the known subsidence area southeast of Williams and into Yolo County depicted in Figure 3.3-11 and the groundwater elevation change in the intermediate aquifer zone southwest of Orland (Exhibit 8.2).

Although there are several areas in the Sacramento Valley of known decrease in groundwater elevations, known areas of subsidence (Faunt, ed., 2009; Exhibit 8.3), and apparently a GPS network with repeated elevation measurements (Exhibit 8.4), the Draft EIS/EIR doesn't provide any specific information on the "strategic" locations where groundwater substitution pumping done under the 10-year transfer project will require additional subsidence monitoring. The historic subsidence data along with the GPS grid elevation data, historic groundwater elevation change data and the future areas of drawdown from the 10 years of groundwater substitution pumping shown in Figures 3.3-26 to 3.3-31 should be sufficient information to develop the initial "strategic" locations for monitoring potential subsidence. The Draft EIS/EIR should be able to provide the specific thresholds of subsidence that will trigger the need for additional extensometer monitoring, 60 continuous GPS monitoring, or extensive land-elevation benchmark surveys by a licensed surveyor as required by GW-1. The Draft EIS/EIR should also specify in mitigation measure GW-1, the frequency and methods of collecting and reporting subsidence measurements, and discuss how the non-participating landowners and the public can obtain this information in a timely manner. In addition, the Draft EIS/EIR should provide a discussion of the thresholds that will trigger implementation of the reimbursement mitigation measure required by GW-1 for repair or modifications to infrastructure damaged by non-reversible subsidence, and the procedures for seeking monetary recovery from subsidence damage (page 3.3-90). The revised Draft EIS/EIR should review the information provided by Galloway and others (2008), and the Pipeline Research Council International (2009) regarding land subsidence hazards.

An objective of the mitigation measure GW-1 is to mitigate adverse environmental effects from groundwater substitution transfer pumping (page 3.3-88). As part of the preliminary assessment of potential environmental impacts from subsidence due to groundwater substitution pumping, a review and determination of the critical structures that might be impacts is recommended. There are a number of critical structures in the Sacramento Valley that may be susceptible to settlement and lateral movement. These include natural 61 gas pipelines, gas transfer and storage facilities, gas wells, railroads, bridges, water and sewer pipelines, water wells, canals, levees, other industrial facilities. Exhibits 8.5 to 8.11 provide several maps of gas pipeline, and gas and oil related facilities obtained from the web sites of the CA Energy Commission (CEC) and the CA Department of Conservation's Division of Oil, Gas and Geothermal Resources (DOGGR). In addition, composite maps (Exhibits 8.1a to 8.1c) are provided that show the locations of the natural gas pipelines (Exhibit 8.6) with the DWR 2004 to 2014 change in groundwater elevation maps (DWR, 2014b). Additional maps of railroads, bridges, canals, levees, water and sewer pipelines and important industrial facilities should be sought and the location of those structures compared to the potential areas of subsidence from groundwater substitution transfer pumping. Specific "strategic" subsidence monitoring locations should be given in mitigation measure GW-1 based on analysis of the susceptible infrastructure locations and the potential subsidence areas. The local, state and federal agencies that regulate these critical structures and pipelines as well as the facility owners should be contacted for information on the limitations on the amount of movement and subsidence the infrastructures can withstand. The limitations on movement and subsidence should be incorporated into any triggers or thresholds for additional monitoring and implementing mitigations needed to reduce subsidence impacts to less than significant and cause no injury.

I recommend that: (1) the Draft EIS/EIR be revised to provide information on initial "strategic" locations and types of subsidence monitoring that are necessary based on the existing conditions and the proposed groundwater substitution pumping areas; (2) the Draft EIS/EIR and mitigation measure GW-1 be revised to provide specific thresholds of subsidence that will trigger the need for additional subsidence monitoring; (3) mitigation measure GW-1 be revised to include the frequency and methods of collecting and reporting subsidence measurements; (4) the Draft EIS/EIR discuss how the non-participating landowners and the public can obtain subsidence information in a timely manner; (5) the Draft EIS/EIR and GW-1 be revised to provide the thresholds that trigger implementation of the reimbursement mitigation measure required by GW-1 for repair or modifications to infrastructure damaged by non-reversible subsidence along with the procedures for seeking monetary recovery from subsidence damage; and (6) the Draft EIS/EIR be revised to provide a map and inventory of critical structures in the Sacramento Valley that may be susceptible to settlement and lateral movement. These structures should include natural gas pipelines, gas transfer and storage facilities, gas wells, power plants, railroads, bridges, water and sewer pipelines, water wells, canals, levees, other industrial facilities. I further recommend that the Draft EIS/EIR solicit advice from local, state and federal agencies, as well as the infrastructure owners on the amount of subsidence that these critical structures and pipelines can withstand, and provide copies of their responses and incorporate their requirements in mitigation measure GW-1 to ensure the stability and function of these facilities. 61

Geology and Seismicity

19. Environmental impacts from the project to geologic and soil resources are discussed in Section 3.4 of the Draft EIS/EIR. The Draft EIS/EIR assumes that because the projects don't *involve the construction or modification of infrastructure that could be adversely affected by seismic events, seismicity is not discussed in this section.* The Geology and Soils section therefore focused on *chemical processes, properties, and potential erodibility of soils due to cropland idling transfers.* Impacts of subsidence are discussed in Section 3.3 of the Draft EIS/EIR and above in my comment no. 18. 62

The Draft EIS/EIR reasoning that because the projects don't involve new construction or modification of existing structures that there are no potential seismic impacts from the activity undertaken during the transfers is incorrect. The project area has numerous

existing structures that could be affected by the groundwater substitution transfer pumping, specifically settlement induced by subsidence. Although the seismicity in the Sacramento Valley is lower than many areas of California, it's not insignificant. There is a potential for the groundwater substitution transfer projects to increase the impacts of seismic shaking because of subsidence causing additional stress on existing structures. The discussion in Section 3.3 on potential subsidence from groundwater substitution pumping was only qualitative because the SACFEM2013 simulations didn't calculate an estimate of subsidence from the transfer projects (page 3.3-61). The subsidence assessment also didn't 62
acknowledge or consider the numerous natural gas pipelines or other critical facilities and structures that occur the Sacramento Valley. Exhibits 8.5 to 8.11 provide a series of maps that show some of the major natural gas pipelines, oil refineries, terminal storage, and power plants in the Sacramento Valley. In addition, there are a number of railroads, bridges, canals, and water and sewer pipelines within the transfer project area. As I discussed in my comment no. 18 on subsidence impacts, some of these existing structures and pipelines are sited within or traverse areas of known subsidence, existing areas of large groundwater drawdown, and areas within the proposed groundwater substitution transfer pumping. There are a number of technical documents on seismic impacts to pipelines (O'Rouke and Norberg, 1992; O'Rouke and Liu, 1999, 2012) as well as a proceeding from a recent ASCE conference on pipelines (Miami, Florida, August 2012).

The characteristics of future seismic shaking in California can be assessed using the following web resources provided by the California Geological Survey (CGS) in conjunction with the U.S. Geological Survey and other academic and professional organizations:

California Fault Activity Map web site:

http://www.quake.ca.gov/gmaps/FAM/faultactivitymap.html

Probabilistic Seismic Hazard Mapping web site:

http://www.consrv.ca.gov/cgs/rghm/psha/pages/index.aspx

Probabilistic Seismic Ground Motion Interpolator web site:

http://www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html

Earthquake Shaking Potential for California Map web site:

http://www.conservation.ca.gov/cgs/information/publications/ms/Documents/MS48_revised.pdf 63

In addition to the potential impacts to existing infrastructure from seismic shaking, the occurrence of faults within the Sacramento Valley may influence the movement of groundwater. The USGS-CVHM groundwater model (Faunt, ed., 2009) incorporated a number of horizontal flow groundwater barriers (Figure C1-A, pages 160, 203, and 204; Exhibits 9.1, 9.2, 9.3a and 9.3b) that appear to align with faults shown in a series of screen plots from the interactive web site 2010 Fault Activity Map for California (CGS, 2010) (Exhibits 9.4a to 9.4d, 9.5 and 9.6). The SACFEM2013 model documentation didn't indicate that faults were considered as potential flow barriers and the resulting simulation maps in Figures 3.3-26 to 3.3-31don't show any flow barriers.

I recommend that the Draft EIS/EIR be revised to: (1) assess the potential environmental impacts from seismic shaking on critical structures and pipelines in areas of potential subsidence caused by the groundwater substitution transfer pumping; (2) provide maps that identify and locate existing pipelines and critical structures such as storage facilities, railroads and bridges within the areas

affected by groundwater substitution pumping; (3) solicit and provide results of the advice from local, state and federal agencies, as well as the infrastructure owners, on the amount of subsidence that these critical structures and pipelines can withstand under in both static and seismic conditions; (4) provide a mitigation measure(s) that addresses the requirements for monitoring the subsidence in the area of these critical structures and pipelines; and (5) provide specific monitoring and reporting requirements for potential seismic impacts to critical structures that includes establishing any additional structures for monitoring and taking subsidence measurements, and conducting additional periodic surveys of ground elevation and displacement. I recommend the Draft EIS/EIR be revised to provide the thresholds that trigger implementation of the reimbursement mitigation measure required by GW-1 for repair or modifications to infrastructure that may be damaged by seismic movement in areas that have exceeded the thresholds for non-reversible subsidence, and provide procedures for seeking monetary recovery from subsidence damage. I also recommend the Draft EIS/EIR be revised to discuss the importance and impacts of the horizontal flow barriers and/or faults within the Sacramento Valley on the results of the drawdown and stream depletion simulations of SACFEM2013. 63

II. Additional Technical Information Relevant to the Assessment of Potential Environmental Impacts from the 10-Year Groundwater Substitution Transfers.

Historic Changes in Groundwater Storage

20. The Draft EIS/EIR provides SACFEM2013 simulations of groundwater substitution transfer pumping effects for WY 1970 to WY 2003. The discussion of the simulation didn't provide specifics on how the model simulated the current conditions of the Sacramento Valley groundwater system or the potential impacts from the 10-year groundwater substitution transfer project based on current conditions. A DWR groundwater contour map, Figure 3.3-4, shows the elevations in the spring of 2013 for wells screened at depths greater than 100 ft. bgs. and less than 400 ft. bgs. Figures 3.3-8 and 3.3-9 provide the locations and simulation hydrographs for selected monitoring wells in the Sacramento Valley. Appendix E provides additional monitoring well simulation hydrographs for selected wells at locations shown on Figures 3.3-26 to 3.3-31. As discusses above in comments no. 7, these hydrographs appear to show only simulated groundwater elevations. Actual measured groundwater elevations are needed to evaluate the accuracy of the simulations. The Draft EIS/EIR briefly discusses on page 3.3-12 the groundwater production, levels and storage for the Redding Basin, and on pages 3.3-21 to 3.3-27 there is a similar discussion for the Sacramento Valley. Faunt (ed., 2009) is cited for the conditions of the Sacramento Valley groundwater budget and Figure 3.3-10, taken from Faunt (ed., 2009; Figure B9; Exhibit 10.2a), shows the historic change in groundwater storage in the Central Valley as determined by the CVHM model simulations. Based in part on the information in Faunt (ed., 2009), the Draft EIS/EIR concludes that the Sacramento Valley basin's groundwater storage has been relatively constant over the long term, decreasing during dry years and increasing during wetter periods. However, the Draft EIR/EIS's discussion of the status of groundwater in the Sacramento Valley doesn't utilize all of the information on groundwater storage or water balance available in Faunt (ed., 2009), more recent simulation studies by Brush and others (2013a and 2013b), or the summary of groundwater conditions in recent reports by the Northern California Water Association (NCWA) (2014a and 2014b). 64

Faunt (ed., 2009) provides in Table B3 (Exhibit 10.1) selected average annual hydrologic budget values for WYs 1962-2003. In addition, Figures B10-A and B10-B of Faunt (ed., 2009) show bar graphs for the average annual groundwater budget for the Sacramento Valley and the Delta and Eastside Streams (Exhibits 10.2b and 10.2c). Table B3 gives the water balances for subregions in the Sacramento Valley (1 to 7) and the Eastside Streams (8). Table B3 gives values for the *net storage from specific yield and compressibility of water*; positive values indicate an increase in storage, while a negative value is a decrease. For Sacramento Valley, the sum of the annual average from 1962 to 2003 in net storage is given as -99,000 AFY and for the Eastside streams -26,000 AFY. Unfortunately, the components in Table B3 don't seem to be a complete groundwater water budget, so following the calculations of the average annual net change in groundwater storage isn't obvious. Figures 10A and 10B (Exhibits 10.2a and10.2b), however, do provide bar graphs of the groundwater water budgets with values for the entire Sacramento Valley and the Delta and Eastside 65
Streams. If it's assumed that groundwater pumping shown as a negative value in Figures 10A and 10B represents an outflow from groundwater storage, then other negative values would also be considered outflows. Positive values are therefore assumed to be inflows to groundwater storage.

For the entire Sacramento Valley (subregions 1 to 7), Faunt (ed., 2009) shows the net change in annual groundwater storage as the sum of the negative outflows and positive inflow in Figure 10A at a negative 650,000 AFY (-0.65 million AFY) (2.88 – [0.29+0.03+1.66+1.37+0.18] = 2.88 – 3.53 = -0.65). The values in Figure 10B can be summed in a similar manner and yield a net change in storage of a positive 90,000 AFY for the Delta and Eastside Streams. Unfortunately, the bar graph in Figure 10B for the Eastside Streams (subregion 8) doesn't have numerical values. A visual comparison of the inflow and outflow bars suggests that for subregion 8 the outflows, mostly pumping, are at or slightly greater than the inflows.

The groundwater budget information by Faunt (ed., 2009) can be compared with two other more recent sources of Sacramento Valley information contained in four documents, Brush and others (2013a and 2013b) and NCWA (2014a and 2014b). Brush and others report on the recent version of the C2VSim groundwater model (version R374) and provide simulation results. The NCWA reports also used the C2VSim (R374) model, but provided 66
additional analysis and results of the historic land development, water use and water balances in Sacramento Valley. Some of the information developed by Brush and others (2013a and 2013b), and Faunt (ed., 2009) on the condition of the Sacramento Valley groundwater system was previously discussed in my comments on the SACFEM2013 model simulations, nos. 8 to 14.

My comment no. 14 on groundwater flow between subregions is also relevant to this discussion of the historic changes in groundwater storage. Accounting for the transfer of groundwater between regions is critical for understanding the impacts of pumping in one region or area on the adjacent regions. The sources of water backfilling a groundwater depression don't all have to come from surface waters, ie., stream depletion, precipitation, deep percolation, and artificial recharge. Some of that "recharge" can come from adjacent aquifers by horizontal and vertical flow. When pumping creates a depression in the water 67
table or piezometric surface, the depression steepens the gradient thereby increasing the rate of flow towards it; the depression can also change the direction of groundwater flow. Often the "recharge" to a pumping depression comes from adjacent groundwater storage that lies outside the zone of influence of the pumping. When the rates and volumes of recharge from surface waters are insufficient to rapidly backfill a pumping depression, the impact on groundwater storage and elevations in adjacent regions increases.

Brush and others (2013a) provide a breakdown of water budget by subregion, Tables 10 to 13 (Exhibits 6.3a to 6.3d), but only for the selected three decades (1922-1929, 1960-1969, and 2000-2009), and for the total modeled period from 1922 to 2009. They do provide values for the change in groundwater storage for all 21 of the Central Valley subregions and 5 hydrologic regions. Of particular importance to the discussion of the current condition of the groundwater basin are the results of the C2VSim simulations of the annual average change in groundwater storage for each of the three decades and from 1922 to 2009, Tables 10 to 13 (Exhibits 6.3a to 6.3d). For the Sacramento Valley (subregions 1 to 7), Table 10 lists the 1922-2009 change in storage as -165,417 AFY (I'm assuming the units of the table are acre-feet), and for the Eastern Streams (subregion 8) -135,304 AFY. For the most recent decade, 2000-2009, the average annual change in groundwater storage has increased in both the Sacramento Valley and the Eastern Streams to -303,425 AFY and -140,715 AFY, respectively (Table 13). Although the tables in Brush and others don't list the groundwater flow between subbasins, Figures 81A to 81C (2013a) and Figure 39 (2013b) (Exhibits 6.1a to 6.1c and 6.2) provide this information for the selected decades and for the total simulation period. As discussed above in my comment no. 14, the change in interbasin groundwater flow can be significant particularly when recharge in a region is deficient. The Draft EIS/EIR should specifically discuss and account for any changes in the rate and direction of interbasin groundwater flow. Interbasin groundwater flow may become a hidden long-term impact that increases the time needed for recovery of groundwater levels from groundwater substitution transfer pumping, and can extend the impact from groundwater substitution transfer pumping to areas outside of the groundwater substitution transfer seller's boundary. 68

Two recent reports on the condition of groundwater in the Sacramento Valley are provided by the Northern California Water Association (NCWA, 2014a and 2014b). Tables 3-6, 3-7, and 3-8 in the NCWA technical supplement report (2014b; Exhibits 10.5a to 10.5c) provide water balance information for the Sacramento Valley for the same three decades as Brush and others (2013a). The NCWA tables separate the water balance elements into three types, land uses (Table 3-6), streams and rivers (Table 3-7), and groundwater (Table 3-8). The values of the change in groundwater storage given in Table 3-8 are similar to those given by Brush and others (2013a). The NCWA technical supplement report (2014b) also provides additional information on the 1922 to 2009 water balance through the use of graphs and bar charts. Figures 3-22 and 3-24 (Exhibits 10.6c and 10.6d) provide graphs of simulated estimates of annual groundwater pumping in the Sacramento Valley and the annual stream accretion. Positive stream accretion occurs when groundwater discharges to surface water, negative when groundwater is recharged. Other graphs include simulated deep percolation, Figures 3-26 and 3-27 (Exhibits 10.6e and 10.6f), annual diversions, Figures 3-19 and 3-20 (Exhibits 10.6a and 10.6b), and relative percentages of surface water to groundwater supplies, Figure 3-29 (10.6g). 69

The NCWA technical supplement report (2014b) notes in Sections 3.8 and 3.8.4 that negative changes in groundwater storage

> *... suggest that the groundwater basin is under stress and experiencing overdraft in some locations. Review of the Sacramento Valley water balance, as characterized based on C2VSim R374 and summarized in Tables 3-6 through 3-8 reveals substantial changes in water balance parameters over time that affect overall groundwater conditions. … Over time, it appears that losses from surface streams have increased as a result of declining groundwater levels. The declining levels result from increased demand for groundwater as a source of supply without corresponding increases in groundwater recharge.* (page 41)

A contributing factor to the decrease in accretions to rivers and streams over the last 90 years is that deep percolation of surface water supplies (and other forms of recharge) has not increased in a manner that offsets increased groundwater pumping. (page 48)

The simulated groundwater pumping graph in NCWA Figure 3-22 and stream accretion graph in NCWA Figure 3-24 were combined into one graph by scaling and adjusting their axes (Exhibits 10.7). The vertical scales of these two graphs were adjusted so that a zero 69 value of stream accretion aligned with 1.5 million acre-feet (MAF) of annual groundwater pumping. This alignment was done to reflect the fact that in the early 1920s, groundwater pumping was approximately 0.5 MAF per year (MAFY) while stream accretion was approximately 1.0 MAFY. As shown in the combined graph, stream accretion generally decreases at approximately the same rate as groundwater pumping increases. Thus, at a point of no appreciable groundwater pumping, pre-1920s, the total long-term average annual stream accretion was likely 1.5 MAF, based on the C2VSim simulations.

Drawn on top of the stream depletion and groundwater pumping graphs are several visually fit, straight trend lines. These lines, which run from 1940 to the mid-1970s and the late 1980s to mid-1990s, are mirror images reflected around the horizontal 0 accretion axis. Information provided at the bottom of the composite graph was taken from NCWA Tables 3-7 and 3-8 (Exhibits 10.5b and 10.5c). The slope of the trend line from 1940 to the mid-1970s is approximately (+-)27,000 AFY, and (+-)85,000 AFY in the late 1980s to the mid-1990s; a 3-fold increase in slope. After the mid-1990s the slope of groundwater pumping flattens to be similar to that of the 1940s–mid-1970s, while the stream depletion line became almost flat, ie., no change in rate of accretion. The reason for the stream depletion 70 rate being flat is unknown, but there are several factors that could contribute to a fixed rate of stream accretion.

First, after depleting 1.5 MAFY from the Sacramento Valley streams, the surface waters may not be able to provide much more, at least no increase to match the pumping. Second, this may also be a consequence of the model design because the number of streams simulated was limited. Third, the model's grid may not extend out far enough to encompass all of the streams that contribute to groundwater recharge. More information on the areas of where streams gain and lose in the Sacramento Valley is needed to determine if there are any sections of stream, gaining or losing, that might still have the ability to interact at a variable rate in the future, ie., during and after the 10-year groundwater substitution transfer project.

A third graph is drawn on the composite accretion-pumping graph in Exhibit 10.7 that shows the C2VSim simulated cumulative change in groundwater storage for the Sacramento Valley from 1922 to 2009. This graph was taken from Figure 35 of Brush and others, 2013b (Exhibit 10.4). A straight trend line with a negative slope of approximately -163,417 AFY is drawn on top of the third graph, which is the value for average annual change in storage from 1922 to 2009 given in Table 10 of Brush and others (2013a; Exhibit 6.3a) for the seven subregions of the Sacramento Valley. The selected graph of the cumulative change in groundwater storage is one of three available. 71

The graph of cumulative change in groundwater storage for the Sacramento Valley in Figure 35 differs from the graph in Figure 83 in Brush and others (2013a; Exhibit 10.3) and in Figure B9 of Faunt (ed., 2009; Exhibit 10.2a). Both of Figure 83 and Figure B9 show a gain in groundwater storage with their Sacramento Valley graphs lying generally above the horizontal line of zero change in storage. The cumulative change in groundwater storage graph from Figure 35 (Exhibit 10.4) was selected because:

- its slope is a close match for the average annual change in storage from 1922 to 2009 of -163,417 AFY given in Table 10,
- the values for change in groundwater storage in the three selected decades are all negative (Table 3-8, NCWA, 2014b), which the other two graphs don't clearly indicate,
- the calculation of average annual change in groundwater storage from 1962 to 2003 shown in Table B3 and Figures B10-A and B10-B of Faunt (ed., 2009) are negative, which conflicts with Figures B9 and 83, and
- change in DWR groundwater elevation maps from spring 2004 to spring 2014 (Exhibit 3.1, 3.2 and 3.3) suggest that there are significant regions of the Sacramento Valley that have lost groundwater storage, which suggests that the current condition is one of a loss in storage rather than a gain. 71

Additional review and analysis of the changes in groundwater storage in the Sacramento Valley is needed. Any additional review of changes in groundwater storage in the Sacramento Valley should consider the recent changes in groundwater elevations such as those shown in DWR (2014b) for WYs 2004 to 2014, and Figures 2-4 and 2-5 of NCWA, 2014b (Exhibit 10.8 and 10.9), as well as other studies such as the support documents for the regional IRWMPs.

I recommend the Draft EIS/EIR be revised to provide a more comprehensive assessment of the historic change in groundwater storage in the Sacramento Valley groundwater basin, and other seller sources areas within the proposed 10-year groundwater substitution transfer project. I also recommend that the Draft EIS/EIR be revised to include an assessment of the impacts of groundwater flow among subregions due to the proposed 10-year groundwater substitution transfer project.

<u>The Concept of the Stream Depletion Factor, SDF</u>

21. The Draft EIS/EIR proposes that a stream depletion factor, BoR-SDF, be applied to groundwater substitution transfers as mitigation for flow losses due to groundwater pumping. The Draft EIS/EIR implies that the BoR-SDF will be a fixed percentage of the transferred groundwater substitution water. The main text of the Draft EIS/EIR doesn't clearly specify the BoR-SDF percentage, but appended documents state that the default is 12%, *unless available monitoring data analyzed by Project Agencies supports the need for the development of a transfer proposal site-specific SDF* (page 33 in the DTIPWTP). Elsewhere in the Draft EIS/EIR, the average annual surface water–groundwater interaction losses are estimated at approximately 15,800 AF and in multiple dry years losses of 71,200 AFY are anticipated (page 3.1-18). The Draft EIS/EIR proposes mitigation measure WS-1, which utilizes the BoR-SDF with the transfers to account for the losses from stream depletions, and thereby reduces the water supply impacts to less than significant (page 3.1-18). As I discussed above in my comment no. 9, the maximum annual groundwater substitution pumping is 290,495 AF as calculated from Table 2-5. The estimated annual average surface water–groundwater interaction loss of 15,800 AF is 5.4 % of the maximum allowable annual groundwater substitution transfer, while a loss of 71,200 AF is 24.5%. 72

    The use of a fixed percentage of transfer water to mitigate increased stream flow losses from the groundwater substitution pumping may not result in the reduction of stream flow impacts to less than significant. I've discussed above in my comment no. 15 several of the issues about the design of mitigation measure WS-1. The following are additional comments on WS-1 specific to the fixed percentage BoR-SDF and how it differs from the concept of stream depletion commonly used in scientific literature.

Jenkins (1968a and b; Barlow and Leake, 2012) defined the "stream depletion factor" (herein called the Jenkins-SDF) as the product of the square of the distance between a well and a surface water body (a^2) multiplied by the storage coefficient (S or Sy) divided by the transmissivity (T) (Jenkins-SDF = $distance^2$ x storage coefficient/transmissivity = a^2 x S/T) (see Table 1 and page 14 in Barlow and Leake, 2012). The units of the Jenkins-SDF are in time, ie., days, years, etc. The Jenkins-SDF also occurs in Theis' well function, *W(u)* (see 73
pages 136 and 150 in Domenico and Schwartz, 1990). Domenico and Schwartz (1990) showed that the Jenkins-SDF can be expressed as a dimensionless Fourier number, which occurs in all unsteady groundwater flow problems. The Jenkins-SDF has several other important characteristics that are not part of the BoR-SDF, which likely influence the actual rate and volume of surface water lost due to groundwater substitution transfer pumping.

1. The value of stream depletion varies with the duration of pumping and unlike the BoR-SDF isn't a fixed value. For an ideal aquifer (homogeneous, isotropic and infinite), two ideal curves normalized to the Jenkins-SDF value can be created that show stream depletion as a percentage of the total pumping rate or total pumped volume against the normalized logarithm of pumping time (see Figure 1 from Miller and Durnford, 2005; Exhibit 11.1). In Figure 1, equation no. 1 shows the instantaneous rate of stream depletion as a percentage of the maximum pumping rate versus the logarithm of normalized time, and equation no. 2 shows the volume of 74
depletion as a percentage of the total volume pumped versus the logarithm of normalized time. Jenkins somewhat arbitrarily defined his SDF as the pumping duration equal to the calculated stream depletion factor (a^2 x S/T). Jenkins noted that for the ideal aquifer at the time of the SDF, the cumulative volume of water depleted from the stream equals 28% of the total volume pumped (Jenkins, 1968a; Wallace and Durnford, 2005 and 2007). As shown in Figure 1 in Exhibit 11.1, when the actual pumping duration is normalized to the Jenkins-SDF, the ideal volume curve always goes through 28% when the pumping time equals the Jenkins-SDF (time/SDF = 1; Jenkins, 1968a).
2. An important factor in the Jenkins-SDF is that stream depletion varies with the square of the distance between the well and the stream, whereas, the depletion rate varies only linearly with changes in S or T. The ratio of T/S is also called the hydraulic diffusivity, D, which has units of $length^2$/time (see Table 1 and Box A in Barlow and Leake, 2012). The rate that hydraulic stress propagates through an 75
aquifer is a function of the diffusivity. Greater values of D result in more rapid propagation of hydraulic stresses. Barlow and Leake (2012) note that the <u>ratio T/S</u> (or T/Sy) controls the timing of stream depletion and not each value individually. Streamflow depletion can occurs more rapidly in confined aquifers than in unconfined aquifers because S is much smaller than Sy, resulting in a larger D value.
3. For a given duration of pumping, the percentage of instantaneous depletion is greater than the percentage of volume depleted. For the ideal aquifer at a pumping duration equal to the Jenkins-SDF value, the instantaneous depletion is 48% of the maximum pumping rate, while the cumulative volume of depletion is 28% of the total pumped volume (Figure 1, Exhibit 11.1). For a non-ideal aquifer where numerical simulations 76
are needed to estimate stream depletion, eg., the SACFEM2013 simulations, the time when the cumulative volume of stream depletion is at 28% of the total volume pumped can be used as an "effective" Jenkins-SDF to allow for evaluation and comparison of potential impacts from pumping.
4. Stream depletion continues to occur after pumping ceases. Jenkins (1968a, b) referred to this as residual depletion. Depending on the duration of pumping and the 77
value of the Jenkins-SDF, stream depletion can be greater after pumping ceases (see

pages 42 to 45 in Barlow and Leake, 2012). Barlow and Leake (2012 on page 43) give the following five key points regarding stream depletion after cessation of pumping:

a. *Maximum depletion can occur after pumping stops, particularly for aquifers with low diffusivity or for large distances between pumping locations and the stream.*
b. *Over the time interval from when pumping starts until the water table recovers to original pre-pumping levels, the volume of depletion will equal the volume pumped.*
c. *Higher aquifer diffusivity and smaller distances between the pumping location and the* 77
stream increase the maximum rate of depletion that occurs through time, but decrease the time interval until water levels are fully recovered after pumping stops.
d. *Lower aquifer diffusivity and larger distances between the pumping location and the stream decrease the maximum rate of depletion that occurs through time, but increase the time interval until water levels are fully recovered after pumping stops.*
e. *Low-permeability streambed sediments, such as those illustrated in figure 11, can extend the period of time during which depletion occurs after pumping stops.*
f. *In many cases, the time from cessation of pumping until full recovery can be longer than the time that the well was pumped.*

5. As noted above in key point no. 4b, the volume of stream depletion will eventually equal the total pumped volume. The time required for full aquifer recovery from pumping depends on the value of the Jenkins-SDF, availability of water to capture, the rate and duration of recharge above what normally occurs, and other factors like the streambed sediment permeability and aquifer layering. Figure 1 in Exhibit 11.1 also shows that for an ideal aquifer the time needed to reach 95% depletion is approximately 127 times the Jenkins-SDF value. This is consistent with the estimates made by Wallace and others (1990) in Table 3 (Exhibit 11.2) on the time it takes to reach 95% depletion, which they consider a point where a new dynamic equilibrium 78
is established. Although the 127-times-SDF multiplier assumes continuous pumping, the fact is the time for full recovery by residual depletion without pumping shouldn't be any sooner than it takes to obtain 95% stream depletion with pumping. In other words, rate and volume of loss from a stream can't be any higher without pumping than with pumping, all other parameters being equal. This means that without some additional source of recharge above what normally occurs, including natural wet and dry cycles, the total time required to achieve full recovery from the 10 years of groundwater substitution transfer pumping will be much longer than the 5 years cited in the Draft EIS/EIR (pages 3.3-80). For additional discussion of the stream depletion under natural variations in recharge and discharge see Maddock and Vionnet (1998).

Another factor that isn't clearly acknowledged in the Draft EIS/EIR is the difference between the instantaneous depletion rate and cumulative volumetric depletion rate. The Draft EIS/EIR appears to focus on cumulative volumetric depletion in mitigation measure WS-1. However, the instantaneous stream depletion rate is probably more important when evaluating impacts to fisheries and stream habitat. The instantaneous rate of flow, instantaneous depth of flow and the corresponding instantaneous wetted perimeter of flow at any point in a stream are the best measures of habitat value to the fish and other water dependent species. The cumulative volume of stream depletion relative to the total pumped 79
volume, on the other hand, can't be easily translated stream to instantaneous flow, water depth or wetted perimeter at a point in a stream because discharges having different hydrographs can result in the same total volume of flow. For example, if I estimate that the stream depletion during a 3- to 6-month period of groundwater substitution pumping will be a maximum of 1 cubic-foot-per-second, I can evaluate the significance of this change to the stream's habitat value using the stream's historic hydrograph and fluvial geomorphology. However, if I estimate that over the same period of pumping the stream will lose, at the end

of pumping, a total 12 percent of the total volume pumped, I can't determine what changes will occur in the habitat function of the stream at a specific time and place. Perhaps, if I assume that the cumulative volume of stream depletion increases linearly with time, going from zero at time zero, to 12% at the end of pumping, then I could also assume that the instantaneous rate of stream depletion would also change linearly from 0% at the start to 24% of the pumping rate at the end of pumping. Remember that in this case the area under 79
the instantaneous depletion curve is triangular, and therefore the maximum instantaneous depletion rate would be twice the total cumulative depletion rate. In reality, the ratio of instantaneous to volumetric depletion for the ideal Jenkins-SDF curves vary with pumping duration; the ratio is approximately 1.7:1 for time/SDF = 1 (Figure 1, Exhibit 11.1). Figure 1 also shows for the ideal curve that when the instantaneous depletion (eq. 1) is 24%, the volumetric depletion is 10% (eq. 2), a ratio of 2.4:1, and when eq. 1 is at 83%, eq. 2 is at 70%, a ratio of 1.19:1.

Mitigation measure WS-1 appears to be based on the cumulative volume of water pumped for each period of groundwater substitution transfers, not the instantaneous rate of stream depletion caused by the pumping. Mitigation measure WS-1 uses of a fixed value for compensating stream losses, which is inconsistent with the hydraulics of stream depletion. Because stream depletion actually increases with pumping time, mitigation measure WS-1 needs to specify the maximum duration of pumping allowed, ensuring that the depletion rate stays below the WS-1 value, ie., 12%. This maximum duration of pumping should be established based on impacts to stream habitat from instantaneous changes in stream flow, 80
not the cumulative change in volume. The maximum duration of allowable pumping would change with the distance between the well and stream and with the diffusivity around each well because these control the rate of stream depletion. The well acceptance criteria in Table B-1 of Appendix B in the DTIPWTP suggests that some calculation has been made to establish the specified setback distances, but no methodology or calculation is given in the Draft EIS/EIR. The Draft EIS/EIR should document how the maximum allowable stream depletion rate, instantaneous and volumetric, and the associated maximum duration of pumping will be calculated for each well in the groundwater substitution transfer project.

Although the Draft EIS/EIR doesn't fully evaluate the potential stream depletion that may occur with the proposed 10-year groundwater substitution transfer project, another report prepared by CH2MHill (2010) and submitted to DWR provides additional analysis on the simulated impacts from the 2009 groundwater substitution transfers. The simulations of the 2009 transfer impacts were done using the SACFEM model, presumably an earlier version of the SACFEM2013 model. Figures 4, 5 and 6 in the CH2MHill 2010 report provide simulation graphs of stream depletion for three groundwater substitution transfer periods, 1976, 1987 and 1994 (Exhibits 11.3a to 11.3c). Graphs (a) to (c) in each figure appear somewhat like Figures B-5 and B-6 in Appendix B of the Draft EIS/EIR in that they show a depletion peak shortly after pumping starts, with a gradual decay following the cessation of pumping. Graphs (d) of Figures 4, 5 and 6 are not provided in the Draft EIS/EIR, but provide 81
important additional information. These (d) graphs show the cumulative depletion for each of the three scenarios and are essentially the volumetric depletion curve of eq. 2 in Miller and Durnford's Figure 1 (Exhibit 11.1). These cumulative volume depletion curves are important because they show the time needed to fully recover from the three groundwater substitution transfer pumping events. For example, Figure 4(d) shows that recovery from the pumping event in 1976 is only approximately 60% after 25 years; much longer than the 5 years for 55% to 75% recovery stated in the Draft EIS/EIR (pages 3.3-70). For comparison, Figure 4(d) of CH2Mhill (2010) is plotted on Miller and Durnford's Figure 1 in Exhibit 11.1 by normalizing the values plotted in 4(d) by an effective Jenkins-SDF value of 2.4 years.

Notice that for the simulated Figure 4(d) Jenkins-SDF curve, depletion initially occurs sooner than with an ideal aquifer, but then depletion slows. At 127 times the SDF, approximately 300 years, the depletion is at approximately 80%.

A point can be identified on each graph (d) where the volume of stream depletion is equal to 28%, the Jenkins-SDF point, and the time since pumping started measured. For example, in Figure 4(d) approximately at approximately 2.4 years after the beginning of pumping the volume of depletion reaches 28%. For Figure 5(d) the time to 28% is similar, estimated at 81
2.3 years. The time interval to 28% volumetric depletion in Figure 6(d) is significantly greater at an estimated 7.5 years. The results presented in both Figures 4 and 5 are from simulation of stream depletion during dry or critically dry years followed by normal or dry years, while the simulation scenario of Figure 6 is for a critical year followed by wet years. All of the cumulative (d) graphs are filtered for the Delta conditions. This may be the reason it takes longer for stream depletion to reach 28% during a wet period than dry period when one might expect the opposite because of the increased stream flow would provides more water for recharge.

The point of this discussion is that the simulated stream depletions from the SACFEM2013 modeling can also be presented as cumulative depletion response curves that are normalized by the effective Jenkin-SDF time. The stream depletion can then be estimated for any rate or duration of pumping at an individual well when the stream depletion response curves given as percentages of both the maximum pumping rate and total volume pumped are normalized to the effective Jenkins-SDF (without the Delta conditions filter). Losses for different distances between the well and surface water feature can be roughly estimated without the need to run another simulation by adjusting the Jenkins-SDF curves by the ratio 82
of the square of the different distances. Cumulative depletion for different pumping rates during and following the 10-year groundwater substitution transfer project can be estimated by the principle of superposition (Wallace and other, 1990; Barlow and Leake, 2012). As I discussed in my comment no. 15b, additional discussion is needed in the Draft EIS/EIR on how the amount of stream depletion for WS-1 is calculated. This discussion should include normalized stream depletion response curves for each groundwater substitution transfer well so that impacts from pumping can be estimated for different pumping durations and rates.

Barlow and Leake (2012) provide an extensive discussion of the factors controlling stream depletion including several misconceptions (pages 39 to 45). Review of their discussion of stream depletion misconceptions is recommended as part of any revision of the Draft EIS/EIR. Barlow and Leake identified the following misconceptions regarding stream depletion (page 39):

- *Misconception 1. Total development of groundwater resources from an aquifer system is "safe" or "sustainable" at rates up to the average rate of recharge.*
- *Misconception 2. Depletion is dependent on the rate and direction of water movement in the aquifer.* 83
- *Misconception 3. Depletion stops when pumping ceases.*
- *Misconception 4. Pumping groundwater exclusively below a confining layer will eliminate the possibility of depletion of surface water connected to the overlying groundwater system.*

I recommend that the Draft EIS/EIR be revised to document stream depletion response curves for each groundwater substitution transfer well. These response curves should be normalized to the effective Jenkins-SDF value, given as a percentage of the pumping rate and total pumped volume, along with the

distance between the well and the modeled surface water feature. Multiple stream depletion response curves should be provided, if necessary. I recommend that the Draft EIS/EIR be revised to review how the BoR-SDF value accounts for the variability in rate and volume of stream depletion. I recommend that the Draft EIS/EIR be revised to document how the maximum allowable instantaneous and volumetric stream depletion rates, and the associated maximum duration of pumping will be calculated for each well in the groundwater substitution transfer project to ensure that the BoR-SDR provides adequate flow mitigation. I recommend that the Draft EIS/EIR be revised to discuss how WS-1 addresses the common stream depletion misconceptions noted by Barlow and Leake (2012). 83

Measurement of Stream Seepage in Real Time

22. Barlow and Leake (2012) state that methods for determining the effects of pumping on stream flow follow two general approaches: (1) collection and analysis of field data, and (2) analytical and numerical modeling (page 50). The Draft EIS/EIR states in the OTIPWTP that stream depletion can't be measured in real time (page 33) and instead relies on simulations of groundwater pumping to determine impacts to surface waters. As discussed in **my comment no. 15b**, the Draft EIS/EIR also states that monitoring of surface water-groundwater interaction is part of mitigation measures WS-1 and GW-1. The statement that stream depletion measurements, ie., stream seepage rates, surface water depths, and surface flows, can't be done in "real time" conflicts with scientific literature. Measurements of stream flow and water depth are fundamental to stream surveys. Although measurement of the seepage rate from or into a stream is done less often and is generally more difficult than other direct surface water measurements, procedures for making these measurements are well documented (Barlow and Leake, 2012; Rosenberry and LaBaugh, 2008; Zamora, 2008; Stonestrom and Constantz, ed., 2003; Constantz, 2008; Kalbus and others, 2006). Linking field measurements to changes in stream flow and seepage to adjacent groundwater pumping is made more difficult because of the lag between the start of pumping and stream response, damping of the pumping response with increases in distance between the well and measured surface water body, and the variation in seepage rate with the increases in pumping time or pumping cycles. Measurements of surface water and groundwater flow are also difficult because of inherent measurement errors that are sometimes greater than the change in flow being sought. Barlow and Leake (2012) discuss the measurement of stream depletion and conclude that: 84

> *Two general approaches are used to monitor streamflow depletion: (1) short-term field tests lasting several hours to several months to determine local-scale effects of pumping from a specific well or well field on streams that are in relative close proximity to the location of withdrawal and (2) statistical analyses of hydrologic and climatic data collected over a period of many years to test correlations between long-term changes in streamflow conditions with basinwide development of groundwater resources. Direct measurement of streamflow depletion is made difficult by the limitations of streamflow-measurement techniques to accurately detect a pumping-induced change in streamflow, the ability to differentiate a pumping-induced change in streamflow from other stresses that cause streamflow fluctuations, and by the diffusive effects of a groundwater system that delay the arrival and reduce the peak effect of a particular pumping stress.* (Page 77)

The Draft EIS/EIR provides the following statements in the DTIPWTP regarding groundwater substitution transfers, which are therefore part of mitigation measure GW-1:

- *… must account for …* the *extent to which transfer-related groundwater pumping decreases*

streamflow (resulting from surface water-groundwater interaction), and the timing of those decreases in available surface water supply. (page 25);
- *Project Agencies are developing tools to more accurately evaluate the impacts of groundwater substitution transfers on streamflow. These tools may be implemented in the near future and may include a site-specific analysis that could be applied to each transfer proposal.* (page 33);
- *Water transfer proponents transferring water via groundwater substitution transfers must establish a monitoring program capable of identifying any adverse transfer related effects before they become significant.* (page 34);

The objectives of the DTIPWTP groundwater substitution transfer-monitoring program include:

- *Determine the extent of surface water-groundwater interaction in the areas where groundwater is pumped for the transfer;* 84
- *Determine the direct effects of transfer pumping on the groundwater basin, observable until March of the year following the transfer;*
- *Assess the magnitude and potential significance of any effects on other legal users of water, instream beneficial uses, the environment, and the economy.* (page 34)

All of these statements and monitoring objectives imply that measurement of impacts to surface water from groundwater substitution transfer pumping is possible. While measurement of stream depletion is complex and problematic, it is possible. The conflicting statements in the Draft EIS/EIR that "real time" measurements can't be done while apparently including a requirement for field monitoring of the effects of stream depletion in mitigation measures WS-1 and GW-1 need further explanation.

I recommend that the Draft EIS/EIR be revised to evaluate and discuss the methods, techniques and procedures available for monitoring and measuring the rate, volume and impacts of stream depletion due to groundwater substitution transfer pumping. The revised Draft EIS/EIR should provide specific mitigation measures, procedures and methods for monitoring groundwater substitution transfer pumping impacts on surface water features, including the frequency of monitoring and reporting.

<u>Other Available Data to Consider in the Establishing Baseline Conditions</u>

23. The Draft EIS/EIR for the 10-year long-term water transfer project should provide a review of the existing technical documents that describe historic environmental, surface water and groundwater conditions in the Sacramento Valley. The information in these technical documents is critical for establish an accurate and complete environmental baseline and for evaluating the potential impacts from future water transfers. Exhibit 12.1 provides an 85 annotated bibliography provided by researchers with AquAlliance (Nora and Jim) of some of the available technical reports on groundwater resources in the Sacramento Valley. In addition to creating a complete bibliography of relevant technical reports, the Draft EIS/EIR should provide an index map showing the areas or locations covered by each report should be developed. For an example of an index map, see the 1:250000 scale regional geologic map sheets produced by the California Geological Survey.

    Other information is likely available from local government agencies that would document the current condition of the groundwater basin both quantity and quality. For example, Exhibit 12.2 has a list provide by B. Smith, a researcher with AquAlliance, of recently well 86 permits issued since January 1, 2009 for wells that have gone dry in Shasta County. A GIS should be used to plot the locations of the wells that have gone dry. The locations of these dry wells should then be compared to the current groundwater levels, past groundwater substitution transfer pumping areas, and the proposed 10-year long-term project pumping areas. This type of spatial analysis would help to establish an accurate baseline on groundwater elevations and impacts on existing wells, and provide the foundation for assessing the potential impacts from the 10-year long-term groundwater substitution transfer pumping. Other relevant information on baseline conditions in the 10-year Transfer Project area can be found in the Integrated Regional Water Management Plans for the Northern Sacramento Valley Basin, the American River Basin, Yuba County, and Yolo County, see my comment no. 6.

I recommend the Draft EIS/EIR be revised to provide an annotated bibliography and index map(s) of all documents that are relevant to proposed 10-year long-term water transfer project and describe or provide data on the historic and environmental, surface water and groundwater baseline conditions in the Sacramento Valley. I also recommend the Draft EIS/EIR be revised to provide information from local and regional agencies on the conditions of wells within their jurisdictions covering at least the last 10 years. This local information should include, if available, replacement well permits issued for dry wells, complaints or treatment systems installed because of poor water quality, and damage to infrastructure from subsidence or settlement. I recommend this information be mapped and compared to areas of past groundwater substitution transfer pumping, areas of known groundwater level depression, and the pumping area for the proposed 10-year project. 86

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List of Exhibits

1.1 – Figure 16 from Barlow and Leake, 2012
1.2 – Figure 29 from Barlow and Leake, 2012
2.1 – Composite map of domestic wells, < 150 ft. bgs depth summary maps for northern Sacramento Valley (DWR, 2014a) and traced shallow zone, well depths < 200 ft. bgs., 2004 to 2014 changes in groundwater elevation (DWR, 2014b)
3.1 – Composite plot of DWR's spring 2004 to spring 2014 groundwater elevation change maps for shallow aquifer zone, well depths less than 200 feet bgs, and Draft EIS/EIR SACFEM2013-1990 hydrologic conditions simulations shown in Figures 3.3-29, aquifer depth approximately 35 feet
3.2 – Composite plot of DWR's spring 2004 to spring 2014 groundwater elevation change maps for intermediate aquifer zone, well depths greater than 200 feet and less than 600 feet bgs, and Draft EIS/EIR SACFEM2013-1990 hydrologic conditions simulations shown in Figures 3.3-30, aquifer depth approximately 200 to 300 feet
3.3 – Composite plot of DWR's spring 2004 to spring 2014 groundwater elevation change maps for deep aquifer zone, well depths greater than 600 feet bgs, and Draft EIS/EIR SACFEM2013-1990 hydrologic conditions simulations shown in Figures 3.3-31, aquifer depth approximately 700 to 900 feet
4.1 – Summary Table of Sacramento Valley Groundwater Model Parameters
4.2 – Table 5, Brush and others, 2013a, C2VSim model parameter ranges
4.3 – Table C8, Faunt, ed., 2009, CVHM model, measured and simulated hydraulic properties
4.4 – Figure 3, Brush and others, 2013a, C2VSim model subregions and hydrologic regions
4.5 – Table A1, Faunt, ed., 2009, CVHM Water-balance subregions within the Central Valley, California
4.6 – Appendix 16.D, Driscoll, 1986, Empirical equations used to estimate specific capacity and transmissivity
4.7a to k – Figures A10A and B (a, b), A12A to E (c to g), A13 (h), A14 (i), C14 (j) and A15 (k) from Faunt, ed., 2009, CVHM model parameters
4.8 a to f – Figures 34A to C (a, b, c), 35A to C (d, e, f), 37A to C (g, h, i), 38A and B(j, k), 39A and B (l, m), page 92 (n) from Brush and others, 2013a, and page 154 (o) from Faunt, ed., 2009
5.1 – Page 100 from Brush and others, 2013a
5.2 – Figure 40, River-bed conductance from Brush and others, 2013a
5.3 – Figure C26, Distribution of cells used for streams, streambed hydraulic conductivity values from Faunt, ed., 2009
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6.1a to c – Figure 81A to C (a, b, c), Simulated average annual subsurface flows between subregions from Brush and others, 2013a
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7.1 – Table summarizing the range of the number of wells in that lie within the spring 2004 to spring 2014 shallow aquifer zone drawdown contours in northern Sacramento Valley from DWR, 2014a and DWR, 2014b (see Exhibit 2.1 for composite map)

8.1a to c – Shallow (a), intermediate (b) and deep (c) composite maps of spring 2004 to spring 2014 groundwater elevation changes in northern Sacramento Valley (DWR, 2014b) with California natural gas pipelines map by California Energy Commission (Exhibit 8.6)
8.2 – Intermediate spring 2004 to spring 2014 groundwater elevation changes in northern Sacramento Valley (DWR, 2014b) with DWR's GPS subsidence grid (DWR, 2008)
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8.4 – Figure 6, Extensometer and GPS survey locations in the Sacramento Valley from DWR, 2008
8.5 – Energy Map of California, Map S-2, 2000, California Department of Conservation, Division of Oil, Gas and Geothermal Resources
8.6 – California Natural Gas Pipelines map by California Energy Commission
8.7 – California Natural Gas Pipelines and Storage Facilities map by California Energy Commission
8.8 – California Oil Refineries and Terminals map by California Energy Commission
8.9 – California Natural Gas Pipelines – Oil Refineries and Terminals map by California Energy Commission
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8.11 – Electric Generation Facilities and Projects Reviewed by the California Energy Commission, 1976 to July, 2014 map by California Energy Commission
9.1 – Figure C1-A, Central Valley Hydrologic Model grid, with horizontal flow barrier from Faunt, ed., 2009
9.2 – Page 160 from Faunt, ed., 2009
9.3a, b – Pages 203 (a) and 204 (b) from Faunt, ed., 2009
9.4a to d – Four screen prints of CGS's 2010 Fault Activity Map of California web site, accesses October 31, 2014
9.5 – Explanation for 2010 Fault Activity Map of California
9.6 – An Explanatory Text to Accompany the Fault Activity Map of California, first 12 pages
10.1 – Table B3 from Faunt, ed., 2009
10.2a to c – Figures B9 (a), B10-A (b) and B10-B (c) from Faunt, ed., 2009
10.3 – Figure 83 from Brush and others, 2013a
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10.5a to c – Tables 3-6 (a), 3-7 (b) and 3-8 (c) from NCWA, 2014b
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10.7 – Composite of Figures 3-22, 3-24 from NCWA, 2014b, and Figure 35 from Brush and others, 2013b
10.8 – Figure 2-4 from Brush and others, 2013b
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11.1 – Figure 1 from Miller and Durnford, 2005
11.2 – Table 3 from Wallace and others, 1990
11.3a to c – Figures 4 (a), 5 (b) and 6 (c) from CH2MHill, 2010
12.1 – Annotated bibliography of reports relevant to groundwater resource assessment in the Sacramento Valley provided by Nora and Jim, researchers with AquAlliance, 11 pages
12.2 – List of permits to replace dry wells in Shasta County provided by B. Smith, researcher with AquAlliance, 2 pages